O P T I M U S RAD + R/F GENERATOR
R e l e a s e 3.5 with XRGSCOPE 3.22 (PC version)

This HELP-manual is in the order of the screens and commands coming up if XRGSCOPE is started on the service PC. It explains the functions and modes in the order of their appearance and explains all functions including the ones which can only be accessed with the PC hardkey, indicated with **>hardkey<**.
They are indicated in chapter FAULTFINDING of the SERVICE MANUAL (generator documentation = doc).

XRGSCOPE 3.22 can be used for **all Optimus** generators release 3.3+3.5 and 2.3 with **one exception** for tube programming:
Release 3 generators must use the TUBE_R3.TDL file (file date 18.4.2001),
release 2 generators TUBE_R2.TDL.
Previous Optimus releases (0.2 / 0.3 / 1.1 / 2.1 / 2.2 / 3.1 / 3.2) are no longer supported.

Text explanations in *'italic letters and quotation marks'* refer to **bold and underlined** screen or item names.

Some **bold and underlined** screen names have red FILE NAMES added. These files have been saved with <F3> online with a generator. To open the files call XRGSCOPE, push <ESC> when it says "Attempting link to device ...", then use "File" and select the file name mentioned. It allows to program the screen within its limits and selectable items as if one is online with the generator.

Note:

Optimus RAD-R/F release 2.x and 3.x CMOS data are up-/downloaded in one string without handshake.
Any kind of interruption can cause the loading process to fail.
Problems occur mainly during the download to the PC.
A download file which is not complete cannot be used as safety backup file.

The service PC can be prepared to guarantee a safe loading process.
XRGSCOPE should be started from DOS if possible.
No screensaver should be active.
No other program, application or CD drive should be active using WINDOWS any version.
Any kind of power management of the PC hardware as well as the WINDOWS power management should be off. If connected to mains power some of these might be automatically off.

Preparing the generator:

At generators which are connected to a system with CAN connected controller
- Thoravision
- Bucky TH + TH2
- Digital Diagnost
- Easy Diagnost systems with a Bucky unit
the CAN connection EZX43 or EZX42-1 + 43-1 must be removed.

The signal bus EZX23 must also be removed at
- Thoravision and
- Digital Diagnost
systems.

Then the generator has to be turned on. The download procedure must not be started before ENK1 energized about 2 minutes after turn-on.

At generators with non-CAN systems the loading process can be started once ENK1 energized.

CU Complete download files and other xxx.TDL files should be mailed in a zipped format.
xxx.TDL files are ASCII files which might be "modified" during mailing..

Do not start XRGSCOPE or FLASH1/2 with NORTON, the loading process might take hours !

Unpacking of the installation disk data files

There are two disks with the documentation. Each disk has a self-extracting **OMA0220x.EXE** and **OMB0230x.EXE** file. The contents of the packed.EXE files are listed in the OMA/OMBxxxx.TXT files attached. A free disk space of 5 MB is required.
Create a directory on the PC hard disk (e.g. C:\OPT_R35) and load all files of both installation disks into the new DIR (copy A:*.* C:\OPT_R35). Run both .EXE files to inflate the programs.
Note! The new tube firmware TUBE_R3.TDL is required to drive the new version of rotor control 4512 104 71421 or 4512 104 71461 with firmware 4512 113 22322/3. It also runs on all predecessor rotor controls 4512 104 71401...6 with firmware 4512 113 22312.

Loading of the Release 3.5 firmware to the Flash PROMs on CU EZ139

Generators (preinstalled or as replacement) and spare CU-PCBs are always delivered with Release 3.5.

Just in case release 3.5 is not loaded in the flash-PROMs it has to be loaded first. Afterwards the generator can be programmed:

- Switch off the generator.
- Select the DIR with release 3.5 XRGSCOPE files.
- Establish the data cable PC (COM1 or 2) <<>> generator CU EZ139 X5.

- Start either program

  FLASH1.BAT using COM1 or
  FLASH2.BAT using COM2.

- Wait, until PC displays:

  Attempting link to device

- Switch on the generator.

Now the firmware will be loaded automatically to the Flash-PROMs on CU EZ139. It takes 15...50 minutes depending on the processor type of the PC.

!!! After the end of the loading procedure (100%) one must wait until the message

Flash Loaded
<OK>

comes up.

It might take up to 10 minutes before the message appears !!

After typing <ENTER> the PC will display a command line

Restart normal.

The normal communication (e.g. to run the setting to work) to the generator can be started now.

If the time between 'Flash Loaded <OK>' and pushing of <ENTER> on the PC takes too long <ESC> has to be pushed once or twice on the PC.

If an original NVRAM still exists, the control desk will come up as usual with the parameters and settings when the generator has been switched off.

If nothing has been programmed or if e.g. the mA_control PCB has been exchanged and no tube has yet been programmed, the control desk will only display PHILIPS OPTIMUS and dots will fill all APR segments. Then the generator has to be programmed according to the local configuration.

Starting of XRGSCOPE

In a DOS environment the command XRGSCOPE must be typed in or a batch file can be programmed.
In a WIN xx environment the command line has to be set according to the WIN version and the PC configuration.

The XRGSCOPE program will start asking for the hardkey password.
Without the hardkey connected the access is restricted.

XRGSCOPE offers additional start commands, an overview is visible with command: " XRGSCOPE ? "

Previous versions of XRGSCOPE offered a "customer" screen at the beginning. It now comes up only if the command "XRGSCOPE customer" is used.

XRGSCOPE c=1 determines the COM port of the PC, ports 1...4 are possible.
If XRGSCOPE is active and the APRMAN program will be started at the same time it automatically takes COM port 2, but it cannot talk to the generator until the cable has been swapped or XRGSCOPE has been closed. APRMAN must be set back to COM1 in the latter case.

Depending on the XRGSCOPE screen which is open one gets a command line at the bottom of the PC screen which offers the available functions and the function keys which can be used:

Select: ↑/↓, <TAB>
Transmit: <F2>
Save: <F3>
Load: <F4>
Cancel: <ESC>

File

Note: During every log-in an entry **00S*** will appear in the error log index to indicate service access to the generator (including APRMANager). To prevent from getting too many 00S* entries one can leave XRGSCOPE active on the PC and turn the generator off. After turn-on the communication generator starts at the same screen which is open on the PC (even if the communication cable has been removed when the generator was off).

- **Open Data File**

  Allows to open data files of the current DIR from which XRGSCOPE has been started. Files can be opened and the content can be displayed. Some files might be too big to be displayed, then a screen "**table too big**" will come up. It depends on the free memory and the file size.
  To enter in the file list push the <TAB> button and select with the cursor buttons or type in the file name. If xxx.TDL files shall be displayed from a floppy disk, just type **A:** in the command line and the file list will be displayed. *'Open Data File'* can also be used offline.

- **Start Macro Recording = Alt+R** Of no practical use for programming or troubleshooting, to be continued.

- **Stop Macro Recording = Alt+S** Of no practical use for programming or troubleshooting, to be continued.

- **Execute Macro = Alt+E** Of no practical use for programming or troubleshooting, to be continued.

- **Load Macro = Alt+L** Of no practical use for programming or troubleshooting, to be continued.

- **Save Macro = Alt+W** Of no practical use for programming or troubleshooting, to be continued.

- **Customer Data** CUSTOMER

  Whenever data screens like *'error log index'* are saved to a xxx.TDL file (function **Save: <F3>** appears in the bottom line), *'customer data'* being saved in the CUSTOMER.TDL file are attached to the saved data screen. It helps to separate saved screen files of different sites, customers or rooms in the same hospital. Site data must be stored in CUSTOMER.TDL file, only data of this file are attached to the saved screens. One can save site specific customer data in self-made files using <F3>. To recall site data use the **Load: <F4>** function.
  Procedure: Either the CUSTOMER.TDL screen is open or open the *'Customer Data'* screen. Push <F4> and select a site data file. The old data screen comes up. Now save this screen with <F3> typing in CUSTOMER as file name.

  - **Customer Name:**
  - **City / State:**
  - **Country:**
  - **Generator Location:**
  - **Generator Serial Number:**
  - **Generator 12 NC:**
  - **Memo1:**
  - **Memo2:**
  - **Memo3:**

  If the customer screen shall not come up type in command XRGSCOPE no_cust when starting XRGSCOPE.

- **Exit Program = Alt+X**

  To leave XRGSCOPE back to DOS (or WIN xx).

Optimus (XRG90) >> Program

Notes:
Several screens, once transmitted with <F2>, are followed by a screen

It is recommended to reset the generator whenever the screen says so. Then one can be sure to get the full functionality of the generator afterwards.
If a generator has to be programmed from scratch one can program as many steps in a row as necessary and make one reset at the end of the programming procedure. It saves a lot of time.
If only a change of a programming screen takes place (e.g. 'RGDV x Data Set A') it would be sufficient to push the RGDV button at the control desk after Transmit <F2> to validate the modified data.

A down-pointing arrow at the end of a programming line allows a selection of values or options after pushing <ENTER>. Select items with the cursor and push <ENTER> or <F2>.

[*Square bracket* **]** *fields allow to enter values within a given range. If the entered value is out of range the limits will automatically be displayed. Value fields without brackets cannot be changed, for reading only.*

- **Date and Time** must to be programmed
  - with a new CU PCB DATETIME
  - after NVRAM erase (battery off)
    (is not part of a *'CU Complete'* backup file)

- **Mains data** MAINS
  - **U_mains_nominal [V]**
    available values = 380 / 400 / 440 / 460 / 480 V
    default value = 400V
    (for 415V select 400V)
  - **Ri_mains [mOhms]**
    range of mains resistance = 0...500 mOhms
    default values: 50kW = 200 mOhms
    65kW = 100 mOhms
    80kW = 100 mOhms

!! It is important to select (U) and type in [Ri] the true values. The calculation of the
!! kV_control for the duty cycle to drive the IGBT's is based on that.

Power reduction table:

			380V	**400V**	**440V**	**460V**	**480V**
Ri for	<	300mOhms	50kW	50kW	50kW	50kW	50kW
Optimus	<	350mOhms	40kW	50kW	50kW	50kW	50kW
50kW	<	400mOhms	30kW	40kW	50kW	50kW	50kW
Single	<	450mOhms	30kW	30kW	40kW	40kW	40kW
Converter		500mOhms	30kW	30kW	30kW	30kW	30kW
Ri for	<	150mOhms	100kW	100kW	100kW	100kW	100kW
Optimus	<	200mOhms	80kW	80kW	100kW	100kW	100kW
65/80kW	<	250mOhms	65kW	65kW	80kW	80kW	80kW
Double	<	300mOhms	50kW	65kW	65kW	65kW	80kW
Converter	<	350mOhms	40kW	50kW	50kW	50kW	65kW
(100kW	<	400mOhms	30kW	40kW	50kW	50kW	50kW
not	<	450mOhms	30kW	30kW	40kW	40kW	40kW
applicable)		500mOhms	30kW	30kW	30kW	30kW	30kW

The max kW limit and with it the max mA is programmed in the function key EZ139 D38 (depending on the customer order, see STAMMKARTE on frontal kV power unit).
If the generator power has been reduced to e.g. 30kW due to a mains resistance of 500mOhms the tube must be re-adapted with the lower mains resistance value to get the full performance at the better mains conditions.

- **Tubes**

- **Tube 1**...3

  - **Tube 1**...3 **Data Set**

    Note! The new tube firmware TUBE_R3.TDL (18.4.2001) is required to drive the new version of rotor control 4512 104 71421 or 4512 104 71461 with firmware 4512 113 22322/3. It also runs on all predecessor rotor controls 4512 104 71401...6 with firmware 4512 113 22312.

    After 35 sec of **Reading** (spinning bar) the screen **Load Data from Disk** comes up offering the default **TUBE_R3.TDL**. file

    With <OK> a screen **Available Tubes (Rel.3 Format)** offers a selection of all available tubes in non-cooled housings ROT350 (250W) or water cooled housings ROT351 (450W). After tube selection a screen **Analyzing** will come up, followed by **Transmitting** and then **Percent transmitted** (how much of file has been loaded to the generator).
    Wait until the PC comes up with the message
    Programming the tube might require the tube load counter to be reset <OK>
    followed by a message to reset the generator.
    D O N O T R E S E T B E F O R E !!

    Single focus tube like RO30: All APR's must get the **large** focus programmed.

    Tube exchange: Do not forget to carry out the *'Reset Tube Statistic'* command.

  - **Tube 1**...3 **Speed Selection** range = 3000...9000 rpm TUBESPEE

    - Exposure rotation [RPM]:
    - Fast Exposure rotation [RPM]: (fast exposure not applicable for Optimus R/F)
    - Fluoroscopy rotation [RPM]: fluoroscopy without rotation is not possible

      The speed for the tube type and technique is automatically taken from the tube data file. Fluoroscopy without rotation is not possible.

    !! **All** stators have to be connected as an SRO tube, see doc INSTALLATION **!!**

- **Tube Limits** (only **[value]** fields can be modified) TUBLIMIT

  Tube: 1 ... 3

  Max. Tube Voltage Limit [kV]: range: **[20...150]** kV

  The value must be programmed according to the max kV of the tube (see tube label). If a tube arcs during adaptation the max kV value can be reduced (or repeat the break in procedure, see doc INSTALLATION). After adaptation the programmed value is the max value which can be selected at the control desk (the adaptation table has no values beyond the limit kV value), even if a higher value is programmed thereafter in this field. The kV value with which the tube has successfully been adapted appears in *'Adapted To [kV]:'*.
  If a tube has been adapted with a higher kV than it should be used for (e.g. max 100kV for veterinary surgeons) the limit must be programmed in this data field afterwards.

  Focus: **small**, **middle**, **large**

  The middle focus would be a third physical filament in a tube (not yet available), it is **not** the VARIO focus.

  Min. Tube Voltage Limit [kV]: range: **[20...150]** kV

  All standard diagnostic tubes of the TUBE_R3.TDL tube file have a default min kV value of 40 kV, it can only be modified in a range > 40kV.

  Adapted To [kV]: gives the max available kV value at the control desk (after adaptation)

If this value shall be increased, first the *'Max Tube Voltage Limit [kV]:'* must be increased. Then the tube has to be readapted afterwards to have the higher kV available for application.

Min. Tube Current Limit [mA]: range: **[0.1 ... 2000]** mA

0.1 mA is the lowest current of the Optimus (fluoroscopy and TDC only).
The lowest mA value one can select at the control desk for exposures is 1 mA.

Max. Tube Current Limit [mA]: range: **[0.1 ... 2000]** mA

The kV dependent max mA value is automatically limited by the tube type **and** the generator version:
OM 50 kW max = 650 mA OM 65 kW max = 900 mA OM 80 kW max = 1100 mA

The max tube mA value is initially set by the tube data set of the tube file and cannot be increased. It will be adapted to the individual focus limits during adaptation (within the total tube limits), the max mA table can be seen in *'Select Unit'* >> *'FU_mA'* >>*'Programming'*.
!! If there is any application reason to decrease the max mA value it is possible, but it will

!! influence all registration devices attached to this tube and might lead to problems, if

!! additional reductions of the emission current and tube power are programmed in the

!! individual *'APR Data Set'*s and/or in *'RGDV Data Set B'*.

- **Capacitance Tube Connection** - formula and table = see doc INSTALLATION CABLECAP
  - **Tube 1** ... 3 **Capacitance on Tube Connection [nF]:**

    range = 2.000nF - 10.000nF, a value of approximately 5.300 nF should never be increased to prevent damages during tube arcing

- **Tube Operating Modes** TU_OP_MO
  - **intermediate boost:** (intermediate boost explanation see doc FAULTFINDING function unit FU_mA)

    enable = double boost mode active (default)

    Active, if emission current (Ie) in a range of **[** Ie max - 20% **] ... [** Ie max **]**
    Inactive, if emission current < **[** Ie max - 20% **]**
    and if *'single step'* has been programmed at 'E*xposure switch type'* at 'D*ata Set A'* .

    Recommended for **children** hospitals and **casualty** rooms (long preparation times).

    disable = single boost mode

  - **rotation prolongation after prep:** **!!** Only possible with HIGH SPEED rotor control units **!!**

    disable = (default)
    Anode stops immediately after exposure end or let go of the PREP hand-switch if PREP has been started from standstill.

    enable = Once started with PREP from standstill the tube keeps rotating for 30 seconds after the last let go of PREP as long as no exposure has been switched.
    The tube finally stops if an exposure has been switched (or after 30 sec).
    Recommended for **children** hospitals and **casualty** rooms.
    - For exposure series, if *'Exposure series / Tomo movement'* = yes has been programmed at RGDV *'Data Set A'.*
      Exposure series have to be started with a fluoro command, afterwards the tube keeps 9000rpm exposure speed for 30 seconds after the last prep or fluoro.

- **Disable Tube**

- If a tube (e.g. 2nd tube) shall be removed from a system one should use this function. If a tube shall be removed temporarily one should do it at the registration device *'RGDV1...8 Data Set A'*.

!! In combination with *'Bucky Ctrl. 1/Dig.Diag.'*: **DO NOT** use this function before all RGDV
!! associated to have been changed to *'none'* instead of *'Bucky Ctrl. 1/Dig.Diag.'*.

- This function **must** be used if a double focus tube shall be replaced by a single focus tube. The non-used small filament circuit of FU_mA must be switched off.
- If a double focus tube shall be replaced by any other type, it is not required to disable the tube. Just load the other tube type according to *'Tube 1...3 Data Set'*.

- **Registration Devices**

  - **RGDV 1** ... 8

    - **RGDV 1**...8 **Data Set A** RGDV_A1

      - **Room:** **Room 1**...3 for room door contact and radiation warning lamp wiring see doc INSTALLATION, WG unit required if more than 1 room

        - to switch over
          - room door contacts (where available)
          - radiation warning lamps

        - indication for PDO (patient data organizer) option prints

      - **Tube:** **None** RGDV not available, *'None'* can be used to disable a RGDV selection without erasing the tube data in mA_control and RGDV setting in CU

        Tube 1...3 a tube must be programmed to enable the RGDV selection

      - **Release circuit number:** **Circuit 1** ... 4

        - one out of four release circuits of a *'Release circuit adaptation unit'* 1WA, 2WA, 1WB, (2WB not yet available)
          (e.g. Adapter for 4 aux. units WA: 1 = EWAX1 2 = EWAX2 3 = EWAX3 4 = EWAX4)
        - **ignore** in case of a *'Bucky Ctrl. 1/Dig. Diag.'* or *'Thoravision'*
        - **ignore**, if *'none'* is programmed for a *'Release circuit adaptation unit'* (e.g. free cassette RGDV without cassette present interlock)

        RGDV number and *'Release circuit number'* **do not** have to be the same, if required all 8 RGDV's can be programmed to one release circuit only.

      - **Enable handswitch at generator desk:**

        yes = release with the desk hand-switch **and** via release decade of WA or WB possible

        'yes' **must** be programmed for systems assigned to *'Mounted radiographical controller'*s *'Bucky Ctrl. 1/Dig. Diag'* or *'Thoravision'*

        no = release via the programmed decade of WA or WB **only** (*'Release circuit number'*)

        'no' **must not** be programmed in combination with *'Bucky Ctrl. 1/Dig. Diag.'* or *'Thoravision'*

      - **Syncmaster present (e.g. grid contact):**

        yes = has to be programmed in case of

        - *'Release circuit adaptation unit'*s (WA/WB):
          - grid synchronization (20-21) decades X1...X4 pins 1-2
          - ditto tomo release (exposure request of layer angle), dec. X1...X4 pins 1-2
          - if cassette present interlock (free cassette) does not use a ready circuit but this sync contact, decades X1...X4 pins 1-2

- BuckyTH, BuckyTH2, Bucky unit of easyD, Digital Diagnost systems via CAN for grid sync, tomo release synchronization **and** free cassette, release via signalbus EZX23 CTRL_X/ **(FCO: BuckyTH 00 231 007, easyD 00 263 009)**
- Thoravision RGDV1 (drum) via signalbus EZX23 CTRL_X/

no = - in case of free cassette RGDV's, no release decade required
then no link has to be inserted to any of the 4 release decades pins 1-2 (20-21) of the adaptation units WA/WB, the free decade can be used for another auxilary
- **must not** be programmed for BuckyTH, BuckyTH2, Bucky unit of easyD, Digital Diagnost and Thoravision systems via CAN
- **must be no** for adaptation at BuckyTH2, Bucky unit at easyDiagnost with BuCo firmware >= 5.x, Digital Diagnost, complete setting see *'Adaptation'*

- **Exposure switch type:**

double step = individual PREPARATION and EXPOSURE request with the desk hand-switch or via the release decades of WA/WB

- **must** be programmed if *'Exposure series / Tomo movement'* = *'yes'*
- **must** be programmed for BuckyTH, BuckyTH2, Bucky unit of easyD, Thoravision and Digital Diagnost systems via CAN

single step = instant EXPOSURE request with PREPARATION only, released from

- the desk hand-switch or
- a release decade at WA/WB or
- the PREP switch S2 of a *'Release circuit adaptation unit'* WA/WB

Does **not** work **without** *'Release circuit adaptation unit'* WA/WB.

- **must not** be programmed if *'Exposure series / Tomo movement'* = *'yes'*
- **must not** be programmed for BuckyTH, BuckyTH2, Bucky unit of easyD, Thoravision and Digital Diagnost systems via CAN

!! If *'intermediate boost'* mode has been *'enable'*d to activate double boost mode, it will automatically be off if *'single step'* is programmed.

- **Bucky format density correction (6% steps):** range = - 8 ... + 8 steps see **[1] page 25**

- , input at WAX11/12 pins 1-2 or WBX11 pins 1-2,
side-fields active when contact closed (>24x24cm), center field only when open

- density correction during collimation with GALILEO collimator Bucky TH, TH2, Thoravision or Digital Diagnost

- **Cone density correction (6% steps):** range = - 8 ... + 8 steps see **[1] page 25**

- correction when cone in use, input at WB X13 pins 4-5, active when closed, Optimus R/F only

- **Dose measurement input:**

none = - **no AEC / AECF / TDC** (*** next page) function available
- **EZX61** in use for dose rate inputs, in this case the **exposure on** signal X_ACT/ has to be connected to the central part via signal bus

EZX21 = chamber 1\
EZX22 = chamber 2 \ to be used for
EZX31 = chamber 3 >backpanel input plugs **Amplimat** and/or

EZX32 = chamber 4 /
EZX41 = chamber 5 /
*** **AEC** = **A**utomatic **E**xposure **C**ontrol (option)
AECF = **AEC** **F**ixed current (if AEC option present) =
TDC = **T**omo **D**ensity **C**ontrol (option)

R/F photo sensor input
(R/F (e.g.DSI) EZX41 preferred)
= Amplimat (DSI) falling load
Amplimat (DSI) kV - mA
= Amplimat (DSI) kV - mA controlled

- **Dose measurement sensor type:**

Bucky amplimat input via **EZX21 / 22 / 31 / 32 / 41**
measuring field selection on control desk possible

Scopo amplimat input via **EZX21 / 22 / 31 / 32 / 41**
only center field displayed at the control desk

!! '*Scopo amplimat'* **must** be programmed in case of a **Junior Diagnost** or **Extremities**
!! measuring chamber to prevent the side-field selection and display.

Photo sensor input via **EZX61**, if *'none'* has been programmed *at 'Dose measurement input'*, the exposure on signal X_ACT/ to the central part has to be connected via signal bus EZX23

Photo sensor/ampl. inp. photo sensor input **only** via **EZX41** to get the **REL** signal (as EXON signal) for AEC **and** all free techniques, e.g. kV-mAs

- **Exposure series / Tomo movement:**

no = instant brake after exposure end
- preferred setting for CAN connected tomo systems BuckyTH, TH2, Digital Diagnost, Bucky units attached to Easy Diagnost systems
to get the underexposure display on in case of system problems or if customers let go the exposure position of the handswitch too early

yes =
- more than one exposure possible with one PREP
- no underexposure display in exposure series / tomo if *'no'* is programmed at *'RGDVx Data Set B' 'Underexposure display (non automatic techniques)'*
- has to be *'yes'* for
  - any tomo in combination with a *'Release decade adaptation unit'* 1WA/2WA (reason: preparation must be active until the tomo stand is back to the start position = „dead-man's" principle)
  - DSI or multiple exposures with SCOPO

(makes **no** sense if *'single step' 'Exposure switch type'* selected)

- **Release delay (automatic techniques):**

enable **Must** be set for AEC / AECF / TDC / PHOTO TIMER techniques to switch on kV not before the dose integrator has been reset and the offset of the chamber signal line has been measured by Dose Rate Control.
Must also be enabled for mobile Amplimat stands without grid sync connected.
- Automatically *'disable'*d if any non-AEC technique is selected.

disable Instant start of kV with EXPOSURE command, should never be programmed.
Must not be programmed using AEC, AECF, TDC technique.

- **Mounted radiographical controller:**

none **!! *'none'* !!** **must** be programmed if any *'Release circuit adaptation unit'* WA / WB is programmed

Bucky Ctrl. 1/Dig. Diag. = RGDV 1...4 BuckyTH and BuckyTH2 via system CAN
RGDV 1...4 Digital Diagnost via system CAN
RGDV 5...8 Bucky unit at easyDiagnost via system CAN

Bucky Controller 2 = not used, ignore

Thoravision = RGDV 1 only at Thoravision,
interface EWD200 via system CAN

- **Release circuit adaptation unit:** (Adapter decade cable for 4 aux units RAD - R/F)

  none = to be programmed in case of free cassette, mobile cassette stands without grid sync contact and if a cassette present interlock is not required

  !! '*none*' !! **must** be selected if any *'Mounted radiographical controller'* is programmed

  1WA = for **Bucky / Tomo**, activates functions:
  - 4 Bucky / Tomo release decades
  - Bucky / Tomo ready contacts
  - collimator format contact >< 24cm Bucky chambers
  - Bucky <> Tomo remote switch-over
  - EXON signal
  - 8 tomo trajectory output lines
  - 8 tomo time input lines
  - external APR module for 2 RGDV + 6 APR
  - PTC (patient thickness correction) module

  2WA = for **Bucky / Tomo**, activates same functions as *'1WA'* except
  - external APR module for 8 APR

  1WB = for **Scopo / Fluoro / DSI / Bucky**, activates functions:
  - 4 Bucky / Fluoro / Scopo / DSI / Tomo release decades (tomo **release** via WB at R/F stands, tomo **functions** only via 1WA/2WA)
  - collimator format contact >< 24cm Bucky chambers
  - Bucky ready contact as common R/F system ready
  - dose rate limiter (6mA fluoro reduced to 3mA fluoro) when active
  - lock-in
  - EXON signal
  - cassette <> camera change-over
  - serial changer format contacts
  - image intensifier format contacts
  - external APR module for 8 APR
  - PTC (patient thickness correction) module
  - external indication of ready + prep or fluoro condition, > 5 min fluoro + incorrect exposure + external reset for errors + fluoro buzzer
  - door contact

  2WB = not yet available

  Note: If an **exposure end beeper** is required in the examination room (even for free cassette) the RGDV must be assigned to the *'Release circuit adaptation unit'* to activate the EXON optocoupler at WA X13/14. R/F systems provide the beeper driven from WBX13.

- **Mounted tomo extension:** only, if at least one *'Release circuit adaptation unit'* **1WA** and/or **2WA** option is present

  none = no tomo auxilary

  !! none !! **must** be selected if *any 'Mounted radiographical controller'* is programmed

  1WA to activate tomo functions, see also *'RGDV1...4 Data Set B' 'Used for tomo'*

  2WA and *RGDV Interface Assignments' 'Decade Bucky 1/2'* + *'Tomo Time'*

- **Medium II format kV corr. (dose equiv. steps):** EWB X13:3 low active
  range = 0...8 dose equivalent + kV correction steps
  1 dose-equivalent kV step recommended (see *'kV steps'* page 13)
- **Medium II format density corr. (-6% steps):** EWB X13:3 low active
  should not be programmed at DSI systems
  range = 0 ... 8 steps of -6% density **[1]**
- **Medium II format mAs corr. (-6% steps):** EWB X13:3 low active
  range = 0 ... 8 steps of -6% mAs **[1]**
- **Small II format kV corr. (dose equiv. steps):** EWB X13:9 low active
  range = 0...8 dose equivalent + kV correction steps
  1 dose-equivalent kV step recommended (see *'kV steps'* page 13)
- **Small II format density corr. (-6% steps):** EWB X13:9 low active
  should not be programmed at DSI systems
  range = 0 ... 8 -6% density steps **[1]**
- **Small II format mAs corr. (-6% steps):** EWB X13:9 low active
  range = 0 ... 8 -6% mAs steps **[1]**

!!! No automatic addition of medium and small correction values **!!!** **[1]** see **page 25**

- **RGDV 1**...8 **Data Set B** RGDV_B1
  - **Used for tomo:**
    no = no tomo functions active
    yes = - must be set if any *'Mounted tomo extension'* is programmed at *'RGDV Data Set A'* (tomo time input active only in combination with option Automatic input of tomo times 9890 000 0222x)
    - must be programmed in connection with a Bucky TH, TH2, Digital Diagnost with TOMO, which gives access to the 16 tomo times (11 only Digital Diagnost) in the System (tomo time input only in combination with option Automatic input of tomo times 9890 000 0222x)
    - if *'yes'* is set exposure time +/- corrections are not possible at the control desk
  - **Used for fluoroscopy:**
    no = no fluoro possible
    yes = - only possible in combination with *'Release decade adaptation unit'* **WB** and if programmed in generator function key EZ139 D38, generator base must be R/F
    - if fluoro is set to *'yes'* the menu/APR field at the control desk line 1 column 2 is reserved to display fluoro parameters (kV, mA, time) and cannot be used for menu or APR names anymore
  - **CT add on:** for therapy simulator purpose, allows run times >= 16 seconds in continuous fluoroscopy mode, function not applicable
  - **Disable time override:**
    no = default, exposure time +/- selection possible at the desk if no tomo RGDV
    yes = disables exposure time +/- corrections at the desk
    if a RDGV is *'Used for tomo'* = yes the time +/- corrections are automatically disabled
  - **Tube power factor [%]:** range = 1...100% of max filament kW, affects all filaments of the

tube assigned to the RGDV

- **kV steps:**
  kV values appear in-between the programmed limits kV_min and kV_max

  Doseequivalent one 6% kV step equals one 25% density steps

  values: 40 - 41 - 42 - 44 - 46 - 48 - 50 - 52 - 55 - 57 - 60 - 63 - 66 - 70 - 73 - 77 - 81 - 85 - 90 - 102 - 109 - 117 - 125 - 133 -141 - 150 kV

  Single = 1 kV steps in-between the programmed limits kV_min and kV_max

- **mAs steps:** 25 % (default), 12 %, 6 % — if film screen combinations with a sensitivity of 400 or higher are in use a 12% stepping should be programmed (for all RGDV)

- **mA steps:** 25 % (default), 12 %, 6 % — if film screen combinations with a sensitivity of 400 or higher are in use a 12% stepping should be programmed (for all RGDV)

- **time steps:** 25 % (default), 12 %, 6 % — if film screen combinations with a sensitivity of 400 or higher are in use a 12% stepping should be programmed (for all RGDV)

- **Density steps:** 25 %, 12 % (default), 6 % — all RGDV should get the same density step factor (and should also be equal to generators next door) (SCP and MedioCP steps are always at 12%)

  !! The density correction displayed at the desk only shows e.g. **-1** or **+2**. This **-1** or **+2** can
  !! stand for (a) step(s) of 6%, 12% or 25%.
  !! All RGDV's (and all systems in the same hospital) should have the same correction factor to
  !! get the same result when used. More explanation in *'Change APR Data Set'*.

- **Density correction (6% steps):** range = - 8 ... + 8 steps (see **[1] page 25**)

  - For individual stand or other registration device related corrections

  !! **No** correction should be programmed before the site specific film-screen combination densities in the ***'Dose Rate Control'*** part have been adjusted.

- **Underexposure display (non automatic techniques):**

  yes The incorrect exposure indicator is blinking at the control desk to indicate that an exposure has not been terminated by the generator (FU_mA controls all **non-AEC** techniques kV-mAs, kV-mA-ms, kV-mAs-ms),
  e.g. if
  - the hand-switch has been released prior to the set exposure time
  - the sweep time switched by the tomo table is shorter than the programmed exposure time
  - the exposure switch is bouncing.

  Preferred setting for CAN connected tomo systems BuckyTH, TH2, Digital Diagnost, Bucky units attached to Easy Diagnost systems to get the underexposure display on in case of system problems or if customers let go the exposure position of the handswitch too early

  no *'no'* **must** be programmed for all non-CAN controlled tomo systems:
  Times switched by a tomo stand might be shorter than the programmed APRT time, ready disappears and the stand will stop.

- **Tube overload protection:**

  on (default), the tube overload protection is on, tube load reductions are active

traffic light status at control desk		
LEDs	load factor [%]	tube temperature
Green	100	cold
green + yellow	100	warm
Yellow	80	medium hot
yellow + red	64	hot
Red	0	**no ready for exposures** 3mA fluoro possible

off **MUST NOT be programmed for RADiographic or R/F sites !!!**

As long as PREP has been started from yellow-red status EXPOSURE is possible with 100% load, even with red light on. PREP is not possible in red, ready disappears.

- **RGDV Interface Assignments**

!!! **Nothing should be programmed in this part if the generator is connected to**
!!! **a *'Bucky Ctrl. 1/Dig. Diag.'* or *'Thoravision'* system via system CAN.**

- **Bucky/Tomo 1WA** and/or **2WA** EWA_X11

- **Decade Bucky 1 (X11)** e.g. WAX11 and/or **Decade Bucky 2 (X12)** WAX12

!! Once a RGDV is programmed all functions of WAX11 or WAX12 are active, functions
!! not provided by the system must be "simulated" with a short-link.

- **Tomo mode switch:**

disable = (default) no Bucky/Tomo remote switchover

enable = enables Bucky/Tomo remote switchover WAX11 or WAX12 pins 3-4, Bucky when open, tomo when closed

If *'enable'* is programmed both Bucky-RGDV **and** Tomo-RGDV have to be programmed (switch related), if only one RGDV is set the generator hangs up

Note: For a stand with only one remote switchover contact using the same set of tomo trajectory / times for **cassette** and **DSI** tomo (e.g. D96) it is sufficient to use one remote switch-over contact only.

- **Bucky RGDV - switch related:** **[2]**

none = default

RGDV 1...**8**

- side field selection for automatic collimators with Bucky chambers, pins 1-2 (closed if > 24x24 cm), density format size correction when programmed
  !! if no automatic collimator present insert a link at pins 1-2 to allow the side field selection
- defines the Bucky RDGV for Bucky/Tomo remote switchover, if *'Tomo mode switch'* is enabled, pins 3-4, (cassette tomo [DSI tomo] = closed, cassette [DSI] = open)
- activates the recognition of the Bucky Ready contact pins 9-10 (ready = closed)

- **Bucky RGDV** **[2]**
- **Bucky RGDV** **[2]**

[2] **three** RGDV's can be programmed at the same Bucky Ready contact

none = default

RGDV 1...**8**

- side field selection for automatic collimators with Bucky chambers, pins 1-2 (closed if > 24x24 cm), density format size correction when programmed
  !! if no automatic collimator present insert a link at pins 1-2 to allow the side field selection
- defines the Bucky RDGV for Bucky/Tomo remote switchover, if *'Tomo mode switch'* is enabled, pins 3-4, (Bucky tomo [DSI tomo] = closed, Bucky [DSI] = open)
- activates the recognition of the Bucky Ready contact pins 9-10 (ready = closed)

- **Tomo RGDV - switch related**

none = default

RGDV 1...**8**

- side field selection for automatic collimators with Bucky chambers, pins 1-2
- defines the Tomo RDGV for Bucky/Tomo remote switchover, if *'Tomo mode switch'* is enabled, pins 3-4, (Bucky tomo [DSI tomo] = closed, Bucky [DSI] = open)
- **must** be set to use option **automatic input of tomo times**,
- activates recognition of the Tomo Ready contact, pins 5-6, (ready = closed)

- **Tomo Time** TOMOTIME

Tomo numbers 1...8 can be programmed in the *'APR Data Set'*s. Programming the times makes only sense if option **automatic input of tomo times** 9890 000 0222x exists (programmed in the CU-function key D38, see STAMMKARTE).
Tomo numbers 1...8 are directly linked to the tomo trajectories WAX22 pins 1...8, while tomo times 1...8 are linked to the tomo time input WAX21 pins 1...8.
The times have to be programmed with times in-between 0.1 ... 6000 ms according to the table type.

*** If tomo APRT's are programmed using option **Automatic input of tomo times**: Select every APRT once. For a very short time the default time of an APRT can be seen at the desk, then the tomo time contact might override the default time. This time must be saved using the desk save function: push and hold the **RESET** labeled button **+ active APRT**. Now the programmed tomo time 1...8 is copied and saved at the APRT data set.
If it is not saved then the default APRT time will come up again if the APRT is pushed a second time or if an APRT with the same tomo time is selected.
The tomo time input only reacts to a high >> low transition of the time contact input.

- If tomo is programmed at *'RGDV Data Set A + B'* it is not possible to change the exposure time at the desk. If APRT with the same tomo trajectory have to be corrected time dependent then an APRT with another tomo trajectory has to be selected. Afterwards select the APRT which has to be modified to get the high >> low time input response.
- It might happen that three tomo times can be seen at the desk after pushing an APRT button: At first the APR time is displayed. The second time might be tomo time number 1, as long as all time input contacts of the tomo stand are open. If then any tomo time contact is closed, the status change will cause the display of the programmed tomo time.

- **Bucky/Scopo 1WB** 1WBREADY

- **Bucky RGDV:**

Eight RGDV's can be programmed at the same system ready contact WBX11 pins 9-10 (R/F controller, ready = closed).
Activates also the format size correction contact (closed if > 24x24 cm) WB X11 pins 1-2 (Bucky chambers only).

!! if no automatic collimator exists, insert a link at pins 1-2 to get access to the side field selection (Bucky chambers only)

- if no Bucky Ready contact exists, but the format size correction has to be active: insert a link at WBX11 pins 9-10 (Bucky chambers only)

- **Dose Rate Control**

  - **AMPLIMAT**

    - **Sensitivity:** AEC_SENS

      high Sensitivity of basic interface chamber signal amplifier is 4 times higher.
      Only possible with PCB EZ150 version 4512 108 05964 and higher, jumper W4 must be in position 1 (factor **x4** even if some PCB layouts have a **x10** printed)
      - *'high'* should be set in case of **TDC** (**T**omo **D**ensity **C**ontrol) option (only with PCB EZ150 >= 4512 108 05964 with jumper W4 in position 1 = x4).
        Exception: If at least one of the Film Screen Combinations of the system has a speed of <200, *'low'* must be selected.
      - *'high'* should be the recommended range if all film screen combinations of the system are >= 200 (only >= 4512 108 05964 with jumper W4 in position 1 = x4).
      - **Must** be high for Digital Diagnost, jumper EZ150 W4 must be in position 1 = x4.

      low (default)

      !! Must be low in case of PCB EZ150 versions up to and including 4512 108 05963 and versions >= 4512 108 05964 if jumper W4 is in position 3 = x1
      'low' must be the recommended range if at least one film screen combination of the system is < 200 (only >= 4512 108 05964 with jumper W4 in position 3 = x1).
      The chamber signal = density voltage "U off" to the dose rate control input of CU (see *'DRC Logging' - 'AEC' - 'AEC Calculation'*) should not increase 10VDC.

      Note: For *'Photo sensor/ampl. inp.'* at *'RGDV Data Set A'* high or low settings must also match with the EZ150 W4 jumper setting. The density voltage *'U_off'* will always be 1V, but at high settings and W4 = x4 DRC terminates the exposure at 4V.

  - **Chamber 1** ... 5

    - **Data Set 1** ... 5 CH1_D1

      - **DRC Handling / Start Automatic DRC Processing**

        Note: For detailed information a booklet **"Radiographic screens and films"** , also including imaging plates, is available: 4512 980 50592.

        - **<OK>** Every empty line of this window has to be filled:

FILM	default data file	:	**FILM.TDL**	**(1)**
SCREEN	ditto	:	**SCREEN.TDL**	**(2)**
CHAMBER	ditto	:	**CHAMBER.TDL**	**(3)**
CASSETTE	ditto	:	**CASSETTE.TDL**	**(4)**
SYSTEM CORRECTION	ditto	:	**SYSCOR.TDL**	**(5)**
CORRECTION FACTOR			range = 0.00 ... 9.99	**(6)**

        >> For **PCR**/FCR/KCR/ADC (computed radiography, imaging plates or dry
        >> cassettes) see details **(1) to (6).**
        >> For Digital Diagnost **DiDi** see also details **(1) to (6).**

        (1) If the film type is not in the default data list, then select one of the film files:
        FILM_BL.TDL (blue), **FILM_GR.TDL (**green), **FILM_UV.TDL** (ultra violet).
        Select the one which matches the sensitivity factor **S** and RLF compensation.
        S is a multiplication factor for the speed type of the screen:
        If the screen = 400 and S_film = 0.5, then the total system is 200.

        PCR: Select from **FILM.TDL:** **X-CONSTANT RLF=1**
        or **IMAGING PLATES**
        DiDi: Select from **FILMFSX.TDL:** **PHIL.Tri-FSXD**

(2) If the screen type is not in the default data list file **LUMAT.TDL** can be selected: It contains the luminous groups LG with different colors and different speeds.

PCR: Select from **LUMAT_LG.TDL:** **LG06 S400 vi** (or any other speed)
or **SCREEN.TDL** **IMAGING PLATE** (200 speed default)
DiDi: Select from **SCREEFSX.TDL:** any of the **S200, S400, S800** speeds

(3) The following table next page gives the PEI-No's of the chambers which can be selected from the data file **CHAMBER.TDL** and the typical dose request values.

PCR: Select from **CHAMBER.TDL:** the installed chamber type
DiDi: Select from **CHAMBFSX.TDL:** **ap DBucky** or **pa DBucky**
ap = lung fields head-side left TH **table**, user side left **wallstand** VE/VT
pa = lung fields head-side right TH **table**, user side right **wallstand** VE/VT
(ap = chamber Side A)
(pa = chamber Side B)

	name in data set	[µGy/V]	supply EZ150 W2/W3 15V / 40V
typical Hybrid	9803 509 . typ.Hybrid	5.85	only 40V
typical ALC	9890 000 ..1 typ.ALC Pb	5.24	15V or 40V
typical ALC	9890 000 ..2 typ.ALC Ag	5.24	15V or 40V
Bucky	9803 509 10002 Bucky	5.85	only 40V
Bucky	9890 000 01611 Bucky	5.24	15V or 40V
Bucky	9890 000 01612 Bucky	5.24	15V or 40V
Bucky	9890 000 01613 Bucky	5.24	15V or 40V
Bucky	9890 000 01614 Bucky	5.24	15V or 40V
Childrens Bucky	9803 509 10102 Ch.Bucky	5.41	only 40V
Childrens Bucky	9890 000 01621 Ch.Bucky	4.81	15V or 40V
Childrens Bucky	9890 000 01622 Ch.Bucky	4.81	15V or 40V
Childrens Bucky	9890 000 01623 Ch.Bucky	4.81	15V or 40V
Chest	9803 509 50002 Chest	5.85	only 40V
Chest	9890 000 01661 Chest	5.24	15V or 40V
Chest	9890 000 01662 Chest	5.24	15V or 40V
Chest	9890 000 01663 Chest	5.24	15V or 40V
Scopomat 42/52	9803 509 30202 Scopo42/52	5.68	only 40V
Scopomat 42/52	9890 000 01651 Scopo42/52	5.08	15V or 40V
Scopomat 42/52	9890 000 01652 Scopo42/52	5.08	15V or 40V
Scopomat 42/52	9890 000 01653 Scopo42/52	5.08	15V or 40V
Scopomat 63/73	9803 509 30002 Scopo63/73	5.32	only 40V
Scopomat 63/73	9890 000 01631 Scopo63/73	4.81	15V or 40V
Scopomat 63/73	9890 000 01632 Scopo63/73	4.81	15V or 40V
Scopomat 63/73	9890 000 01633 Scopo63/73	4.81	15V or 40V
Scopomat 71/74	9803 509 30102 Scopo71/74	5.15	only 40V
Scopomat 71/74	9890 000 01641 Scopo71/74	4.63	15V or 40V
Scopomat 71/74	9890 000 01642 Scopo71/74	4.63	15V or 40V
Neuro Diagnost	9803 509 50102 Neuro D.	8.06	only 40V
Neuro Diagnost	9890 000 01671 Neuro D.	7.14	15V or 40V
Neuro Diagnost	9890 000 01672 Neuro D.	7.14	15V or 40V
Neuro Diagnost	9890 000 01673 Neuro D.	7.14	15V or 40V
Cranio Diagnost	9803 509 50602 Cranio D.	8.06	only 40V
Cranio Diagnost	9890 000 01681 Cranio D.	7.14	15V or 40V
Cranio Diagnost	9890 000 01682 Cranio D.	7.14	15V or 40V
Cranio Diagnost	9890 000 01683 Cranio D.	7.14	15V or 40V
Puck 35x35	9803 509 60002 Puck 35x35	4.37	only 40V
Puck 35x35	9890 000 01691 Puck 35x35	3.94	15V or 40V
Puck 35x35	9890 000 01692 Puck 35x35	3.94	15V or 40V
DigitBucky ap	9890 000 02671 DigitBucky ap	3.60	15V or 40V
DigitBucky pa	9890 000 02671 DigitBucky pa	4.50	15V or 40V
Extremities	4512 102 80261 Extremity	10.10	only 40V
Extremities	4512 104 47621 Extremity	1.14	15V or 40V

	(9803 509 51202)		
Junior Diagnost	4512 103 06661 Junior D.	3.32	only 40V
	(9890 509 51202)		
Junior Diagnost	4512 104 47621 Junior D.	1.14	15V or 40V
	(9803 509 51202)		
Mammo Diagnost	4512 127 98802 MammD.	3.32	only 40V
Mammo Diagnost	4512 127 98803 MammD.	1.40	15V or 40V
Mammo UCBC	4512 104 18811 MamUCBC	3.32	only 40V
Mammo	4512 104 47621 Mammo	1.40	15V or 40V
	(9803 509 51202)		
	X-CONSTANT DV=1VOLT	5.00	

(4) normal cassette (default) Al double sided screen (factor 1.00)
carbon fiber cassette double sided screen (factor 1.12)
1/2 screen normal cassetteAl singe side screen (factor 0.50)
1/2 screen carbon fiber cassette singe side screen (factor 0.56)
[factors cannot be changed]

PCR + DiDi: Select **normal cassette(def)**

(5) no correction (ISO9236-1) = linear kV behavior

low-kV-correction = correction factors kV dependent:

kV	40	50	60	70	80	90	100	120	140	150
factor	0.7	0.78	0.89	1.0	0.99	0.95	0.92	0.94	0.98	1.0

PCR + DiDi: Select **no corr.(ISO9236-1)**

(6) The default value is 1 representing a density of 1.0. If no PC-hardkey exists, the density adjustment must be carried out by typing in the appropriate factor.

PCR + DiDi: **1.00**

Without a PC hardkey: If the value has to be changed to the desired density after a test exposure + density measurement, the entire set has to be programmed again with a new correction factor.
If the PC-hardkey exists, use the function *'Start Automatic DRC Processing'* >> *'<CANCEL>'* and keep the correction value on 1, if not use the following formula:

$$\frac{\text{desired density}}{\text{measured density}} = \text{new [`CORRECTION FACTOR']}$$

The name of the FSC is the abbreviation of the resulting speed and the color of the film screen combination. There might be names like **B400** for a blue 400 speed combination or **G200** for a green 200 speed combination. The default abbreviation name is taken from the speed class of the screen data set.
The name can be changed (only with the PC-hardkey), see *'Start Automatic DRC Processing'* = *'<CANCEL>'* or *'<ESC>'*.
The name **must** be changed if different film screen systems with the same resulting name exist, otherwise the change from e.g. one G200 to a second one cannot be recognized at the control desk.
Combinations of systems with different colors cannot be programmed (not allowed by government law in most of the countries) the automatic way (even though they are used), it requires a special procedure.

If film screen combinations are used at different chambers a data set can easily be copied to other chambers/data sets once the first has been programmed (only with the PC-hardkey):
Use the *'<CANCEL>'* function, the data screen will be displayed. With the **Save** function **<F3>** the data screen can be loaded to the disk/hard disk with any file name (e.g. Ch1D1). If a data set is opened at another chamber the saved file can be **Load**ed with **<F4>** + file name to the open data set. **Transmit** the data

set with **<F2>** thereafter. The density alignment must be carried out for each chamber + data set.

- **<CANCEL>** or use <ESC> >hardkey<

Only two values of the *'Data Set'*s of the *'Chamber'*s should be changed: *'Abbreviation'* and *'Dose of FSC'*.
All others **must not** be changed (e.g. all kV dependent characteristics).

If digital cassettes / imaging plates (PCR/FCR/KCR) type the desired sensitivity (e.g. PCR200) in the *'Abbreviation'* field. Digital Diagnost and Thoravision provide special speed Sxxx or DOSE names.

The value *'Dose of FSC [µGy]:'* = K_s must be calculated:

$$\frac{1000\mu Gy}{\text{speed system}} = K_s \qquad \text{example:} \quad \frac{1000\mu Gy}{200} = 5\mu Gy$$

Abbreviation:

The name of the film screen combination can be changed into every 6 digit string.
An FSC can be erased by filling the name field with blanks,
but: !!
There should **never** be a gap in-between the FSC data sets of a chamber. If only one FSC is used, it **must** be at data set 1, the second **must** be on 2 etc. If e.g. 4 data sets are active and the 1st will be erased by blanks (spaces), all FSC's disappear and AEC is no more available for this RGDV.
If any FSC will be removed from the last position all APR linked to this FSC have to be programmed to any other still existing FSC, otherwise no FSC will be displayed at the desk. When these APR are changed to another FSC the background mAs values have to be adapted to the FSC sensitivity.

Since Release 3 predefined APR data sets can be programmed with the FSC name = *'Abbreviation'*. If the abbreviation string and the name in the APR data set are identical, the FSC will be associated to the APR data set.
If no name is given in the default APR data sets, APR will be assigned to the FSC which has the closest *'Dose of FSC[µGy]:'* value to the **Recommended Dose** in the default APR data sets. The value can only be seen with the help of **APRMAN**ager if the APR data screen is open or with the print preview.

Dose Request Chamber [µGy/V]: range: 0.50...32 µGy/V

Sensitivity of the selected measuring chamber.
Value must not be changed !

Dose of FSC [µGy]: range: 0.45...100 µGy

The initial value *'Dose of FSC [µGy]:'* of the *'DRC Handling / Start Automatic DRC Processing'* (calculated by XRGSCOPE in the service PC) is set to achieve a density of **1.0**.
It can be changed according to the customers density "taste", e.g. 1.5:

$$\frac{\text{desired density}}{\text{measured density}} * \text{default } \textit{[Dose of FSC]} = \text{new } \textit{[Dose of FSC]}$$

If default APR of the installation disk are selected with AEC technique the exposure data at the desk will display the abbreviation of the FSC and a default **zero** with a triangle for the density. This **zero** should be the basic value for the desired density. It will not change whatever value for the *'[Dose of FSC]'* is programmed.

- **Image Intensifier** IMA_INTE

  The II lead time, density voltage correction (default 1V), and the dynamic factors must be modified according to the II type.

- **Fault Exposure Detection**

  - **AEC** Detailed explanation and sketches see doc FAULTFINDING

    off = No 4% dose supervision at 10% of the backup exposure time, automatically off after APR overriding

    on = (default) At 10 % of the backup exposure time (APR mAs value) DRC detects if at least 4% of the expected dose (signal must be > 20mV) have been measured. If not, the exposure will be switched off by CU.

  - **TDC** Detailed explanation and sketches see doc FAULTFINDING

    off = No 4% dose supervision at 10% of the backup exposure time, automatically off after APR overriding

    on = (default) At 10 % of the backup exposure time (APR mAs value, not before 250ms, tomo time > 1000ms) DRC detects if at least 4% of the expected dose (signal must be > 20mV) have been measured. If not, the exposure will be switched off by CU.

- **CONT** factors for continuous fluoroscopy can be modified: CON_FLUO

  scantime_TV [ms]: default = 20 ms (must be 20 ms for 50 **and** 60 Hz)
  range = 0 ... 60000 ms

  scantime_TV valid: **yes** = default
  must be *'yes'* without CAN driven R/F system controller

  no = only possible with a CAN driven R/F system controller

  P_max_EDL [W]: default = 250W
  range = 0 ... 9000 W, max entrance dose limitation, active, if WB X12 pins 1-10 closed (SID < 100 cm) see doc ADJUSTMENTS

  TV_pos_limit [V]: default = 6.885 V
  range = +3 ... +7.5 V ADC input of TV chain

  TV_neg_limit [V]: default = -6.885 V
  range = -7.5 ... -3 V ADC input of TV chain

- **Fluoroscopy Curves** FLUO_CU1

  20 Fluoroscopy curve memories can be loaded with one of the 3 predefined fluoro curves of the installation disk file **FLUOCURV.TDL**:

default curves FLUOCURV.TDL	**start values** 50 kV	**kV-mA characteristic**								
		40	50	60	70	80	90	100	110	kV
6mA default 1	0.5 mA	0.25	0.5	0.95	1.7	3.0	5.0	5.5	6.0	mA
6mA default 2	0.4 mA	0.25	0.4	0.6	0.8	2.0	4.0	5.0	6.0	mA
3mA	0.5 mA	0.22	0.42	0.7	1.2	2.15	2.7	2.95	3.0	mA

  One out of the programmed curves (1...20) has to be attached to the APR data set, see *'Change APR'*.

  If other curves for special applications are required, send a request to Helpdesk Hamburg.

- **Application Limits**

  - **X-Mode Limits** X_MO_LIM

    Limits can be modified within the range of the value fields. The displayed default limit values are higher than the values which can be selected at the control desk.
    Values should not increase the local regulation limits.

    - **Min. Time Limit [ms]:**

      The shortest exposure time possible is 1ms.

      A short exposure time in combination with a low emission current can cause an error 00L$ if the resulting mAs value is below 0.5 mAs (only if sent online with XRGSCOPE).

    - **Max. Time Limit [ms]:**

      The max exposure time which can be selected at the control desk is always **16000** ms.
      If **tomo** is programmed the max exposure time is **6000** ms.
      60000 ms is only available if *'CT add on'* has been selected at *'RGDVx Data Set B'* and if option is present.
      !!! The max time limit for AEC must not be shorter than 4000 ms, 6000 ms for TDC !!!
      Otherwise error 00L3 comes up and the generator might be dead afterwards.

    - **Min. Current Time Product Limit [mAs]:**

      0.5 mAs is the lowest value one can select at the control desk (any non-AEC technique **RUIT** = kV-mA-ms, **RUQ** = kV-mAs, **RUQT** = kV-mAs-ms).

      A short exposure time in combination with a low emission current can cause an error 00L$ if the resulting mAs value is below 0.5 mAs (only if sent online with XRGSCOPE).

    - **Max. Current Time Product Limit [mAs]:**

      AEC = AEC falling load**, AECF** = AEC fixed current and **TDC** = Tomo Density Control techniques have a default **max mAs** limit of **580 mAs** programmed to meet the HHS limit of 600mAs (AEC and AECF use the same limit).

      Even if the non-AEC techniques **RUIT, RUQ, RUQT** show 1000mAs as default limit, the absolute limit which can be selected at the control desk is **850mAs**.
      It can also be selected in HHS countries which are limited at 600mAs for AEC exposures.

  - **Thoravision Limits** THO_LIMI

    Table of default max mAs values (kV dependent) to prevent an over-saturation of the Thoravision detector drum (**memory effect**).

  - **Overload dependent Limits** for continuous fluoroscopy OLO_LIMI

    Max. current for conti. fluoro [mA]: range = 3 ... 20 mA

    Max. current during overl. for conti. fluoro [mA]: range = 1 ... 3 mA

    overload conditions, (red traffic light on only):
    - tube housing temperature contact open
    - tube temperature supervision TTS (calculated) detected overload

- **Human Interface**

  - **Select Language** **English** / **German** Messages like **door open**, **menu** etc. and language dependent characters

LANGUAGE **French** (table see doc INSTALLATION) are
Spanish related to the programmed language.

- **APR Data Set** SEL_APR

- **Select APR Data Set**

  Select any APR at the desk, the name will be highlighted. After <ENTER> at the PC the APR-# will be displayed on the PC screen. This # can be used for *'Inquire APR Assignments'* or to move APR.
  Once this *'Select APR Data Set'* window is transmitted with <F2>, the following *'Change APR Data Set'* command allows to look into the complete APR data set.
  (It is **not** possible with the default **Test APR**.)
  Any APR # in-between 1 and 1024 can be typed in, no matter if this APR # is assigned to a RGDV or not.

- **Change APR Data Set** CHA_APR

  This function opens the window to modify the entire APR data set. Data marked with a **[P]** can **only** be changed in this window via service PC or with the APRMANager.
  All other non-marked data can also be changed at the desk and saved thereafter via the button combination **RESET** (hold it) + the **highlighted APR**,
  but: see *'APR modifiable by User'.*
  (*'Change APR Data Set'* is **not** possible with the default **Test APR**.)

  Note: If only a few APR data sets have to be maintained one can use these functions. If more APR data sets shall be modified the use of **APRMAN.EXE** (part of the installation disk) is much easier, more convenient and a lot faster.

  - **[P]APR number:** is just a (randomly given) pointer (house number)

    This number can be used to copy a data set into another data set. To do so the destination APR number (*'Select APR Data Set'*) has to be filled in the *'APR number'* field, afterwards transmit with <F2>. The source data set does not change.
    To move an APR data set copy a data set to the desired destination and delete the source APR data set afterwards with *'APR deassign'*.
    There has to be an active destination APR. Error 00BR will come up if a data set is loaded/ copied to an APR number which is not assigned to any RGDV.
    If APR backups are reloaded the APR numbers of the backup file will be the same after reloading except
    - if the APR numbers are already occupied
    - if a default data set from the installation disk is used
    - if an individual RGDV backup file will be loaded to another RGDV of the same generator.

    Note: *'APR number'*s should not be changed if the generator is in combination with a BuckyTH or TH2 system via CAN. Otherwise the assignment of APR#s for the control handle will be lost.

  - **[P]APR name:** 16 characters are possible

    If special letters are needed (language dependent) see doc INSTALLATION character codes.

    Note: Since Bucky controller release 5.x for BuckyTH2 an "=" character **must** be at the end of the APR name string to get a ready display for grid used RGDV / APR.
    APR for RGDVs 1+2+3 with **Inalfa** trays must always have the "=".
    APR for **ACL4** trays with removable grid must have the "=" when the grid shall be used
    and **no "="** when the **grid** shall **not be used** (removed from the tray to get a system ready) for application reasons.

    Digital Diagnost systems also require the "=" character for a system ready when the grid shall be used and no "=" without grid.

If APR data are changed at the desk the two last digits of the 16 character field will be used to indicate '_*' = 'overriding'.
Example: **[infant 10-15 yrs]** will change to **[infant 10-15 y_*]** after overriding.

- **Focus:** **small** = small filament of the tube
  middle = (in case of a 3 focal spot tube, not yet available)
  large = large filament of the tube
  vario = is a virtual focal spot, its size (tube type dependent) in-between large and small focus can be selected via the *'Vario focus ratio'*, only with **RO17/50, SRO09/51, SRO25/50, SRO33/100** tubes with superimposed focal spots and if option is present

- **[P]Vario focus ratio**: range: 20%, 35%, 50% (default) , 65%, 80% of small focus

  Sets the ratio of small and large focus, for tubes with superimposed focal spots.
  If possible indicate the ratio in the *'APR name'* field.
  Example: 'Thorax_ap____50%'
  To get the best application exposure parameters use APRMANager, it takes the tube current limits into account and calculates the optimum.

- **([P]) Dose measurement field (left): on / off**
  Dose measurement field (middle): on / off
  Dose measurement field (right): on / off

  At least one of the measuring fields must be *'on'* to have access to AEC, AECF or TDC no matter if the *'Preferred technique'* is set to *Automatic'* or *'Non automatic'*.
  A chamber must be programmed at *'RGDVx Data Set A'* + *'Dose measurement input'*.
  The default APR data set [### APR name ###] has all 3 fields *'on'*.

  Some customers like ho have **technique APR's** only. If so switch *'off'* all fields for the non-AEC techniques so that there is no way to change to AEC technique if AEC is possible at the same RGDV / menu / page.
  If a Mobile Cassette Stand MCS is used at RGDV4 together with free cassette of a BuckyTH, TH2 system the APR/menu structure should offer free cassette APR with all fields off and
  MCS APR with the required field(s) on.

- **[P]Preferred technique:**

  Non automatic

  One of the three *'No AEC technique'*s will be displayed at the major exposure data display.
  With the **mA-s** labeled button at the desk one can switch over from **kV-mA-ms** (LED on) to either **kV-mAs** or **kV-mAs-ms** technique (LED off), depending on what has been programmed.
  If a *'Dose measurement input'* and/or *'Dose measurement sensor type'* is programmed at *'RGDVx Data Set A'* and at least one *'dose measurement field'* is *'on'* one can switch over to AEC technique, which will cause the overriding sign ' _*' coming up.

  Automatic

  AEC / AECF / TDC technique will appear when this APR is selected (AEC technique button LED and 1...3 measuring field LED's on).

  *** Most of the predefined APR data sets from the installation disk are programmed for a 400 speed system (Recommended Dose: 2.5 μGy). If these are taken all organ dependent mAs values have to be adapted to the local film speed systems (doubled for 200 speed systems, divided by 2 for 800 speed systems).

- **[P]AEC technique:**

AEC falling load kV the kV dependent mA start value of the falling load exposure will appear in the *'Exposure data I [mA]'* field

AEC fixed current kV-mA the fixed mA value has to programmed in the *'Exposure data I [mA]'* field, mA **and** exposure time values have to match the required organ dependent mAs

Select **kV-mA-ms (RUIT)** at *'No AEC technique'*

TDC (Tomo Density Control) (option 9890 000 0223x, see STAMMKARTE)

the TDC start mA value has to be programmed in the *'Exposure data I [mA]'* field
or
the desired mAs value in the *'Exposure data Q [mAs]:'* field in combination with the tomo sweep time = *'Exposure data t [ms]:'*

Select ***'kV-mA-ms (RUIT)'*** or ***'kV-mAs-ms (RUQT)'*** at *'No AEC technique'*

- **[P]No AEC technique:** = all non-Amplimat techniques

Two out of the three *'No AEC technique'*s are available for every APR.
If either **kV-mAs** or **kV-mAs-ms** technique is selected one can switch over to **kV-mA-ms** technique pushing the "**mA-s**" labeled button at the desk.
If **kV-mA-ms** (LED on) is programmed as preferred non-AEC technique and if it will be deselected by pushing the "**mA-s**" labeled button (LED off) it changes to **kV-mAs** technique only.
The preferred *'No AEC technique'* after AEC-deselect can be changed at the control desk with the overriding-save function.

!!! If **kV-mAs-ms** technique is programmed as preferred non-AEC technique it will change to **kV-mAs** if the APR data set has been modified at the control desk and has been saved with **kV-mA-ms** technique selected (only at non-tomo RGDV) **!!!**

kV-mA-ms technique (RUIT) (**R**adiographic **kV-mA-s**), choice of **kV**, **mA** and **ms** parameters

Must be selected in case of *'AEC fixed current kV-mA'* as preferred AEC technique and can be selected for *'TDC (Tomo Density Control)'* techniques.

kV-mAs technique (RUQ) **R**adiographic **kV-mAs**, choice of **kV** and **mAs** parameters

kV-mAs-ms technique (RUQT) **R**adiographic **kV-mAs-s**, choice of **kV**, **mAs** and **ms** parameters

Should be selected as the best non-AEC technique for TDC technique APR.

This technique is very helpful at simple tomography stands (e.g. replacement, no chamber for TDC). Exposure time and mAs can be selected individually depending on the tomo sweep time and the organ & patient size, **but:**
Time +/- selection is not possible if RGDV is programmed *'Used for tomo = yes'* at *'RGDVx Data Set B'*. It must be programmed in the APR or the time selection is controlled by automatic input of tomo times (decade WAX21 or Bucky controller).

Note: Depending on which of the three non-AEC techniques is selected only the relevant parameters in the following *'Exposure data nn [xx]'* have to be modified. All other parameters will be calculated by the generator itself after transmission with <F2>. If the same APR data set screen will be called again, the calculated "slave values" appear.

*** Most of the predefined APR data sets from the installation disk are programmed for a 400 speed system (Recommended Dose: 2.5 µGy). If these are taken all organ

dependent mAs values have to be adapted to the local film speed systems (doubled for 200 speed systems, divided by 2 for 800 speed systems).

- **[P]** **Tube current max. factor [%]:** range = 1...100% (default 100 %)

  The max emission current can be modified within the above range.
  The reduced current (see *'Exposure data I [mA]'*) will be the start mA value of an AEC falling load exposure. It can also be the max mA value e.g. for an AEC fixed current exposure. It will be a constant value during the exposure until it comes to a point where the mA have to be reduced (falling load) within 4000ms. The mA value as the result of the % reduction is different for each kV value.

  The mA value can be seen if the APR data set screen has been transmitted with <F2> once. Call the same *'Change APR'* data set again and the calculated mA value appears. Another way to see the mA is at the desk: Push the APR button, switch off AEC. The background technique will come up. In case of kV-mAs or kV-mAs-s push the "mA-s" labeled button to switch over to kV-mA-ms technique. The displayed mA is the value which is one step below the max value in the row of the programmed mA steps (*see 'RGDVx Data Set B'*). Now push the +mA button to get the max mA value. This is identical to the data set displayed on the PC screen.
  If an APR with small focus will be changed by pushing the large focus button the +mA has to be pushed until the max value appears. A change from large to small will immediately display the max mA.
  !! The modification of the max factor will lead error 00L$ if the resulting mAs value is below 0.5 mAs.
  !! Take care that there are not too many additional reductions programmed **!!**

- **[P]** **PSC U thin (dose equivalent steps):** range = 0...-5 dose equiv. kV steps

  Patients **S**ize **C**orrection kV slim patient

- **[P]** **PSC U thick (dose equivalent steps):** range = 0...+5 dose equiv. kV steps

  Patients **S**ize **C**orrection kV thick patient

- **[P]** **PSC Q thin (6% steps):** range = 0...-10 mAs steps see **[1] page 25**

  Patients **S**ize **C**orrection mAs slim patient

- **[P]** **PSC Q thick (6% steps):** range = 0...+10 mAs steps see **[1] page 25**

  Patients **S**ize **C**orrection mAs thick patient

- **[P]** **PSC density thin (6% steps):** range = 0...-10 dens. steps see **[1] page 25**

  Patients **S**ize **C**orrection density correction slim patient, max limit possible = - 8 steps

- **[P]** **PSC density thick (6% steps):** range = 0...+10 dens. steps see **[1] page 25**

  Patients **S**ize **C**orrection density correction thick patient, max limit possible = + 8 steps

[1] Depending on the step rate of **mAs-** and **density-correction** programmed at *'RGDVx Data Set B'* these correction values must have an even factor with the basic step rate:
For one 25 % mAs-correction step (programmed at *'RGDVx Data Set B'*) four 6%-steps have to be programmed.
To get a +1 density step displayed two 6% steps have to be programmed if 12% *'Density steps'* are programmed at *'RGDVx Data Set B'*.

- **Exposure data U [kV]:** range = 40...150 kV or what has been programmed at *'Tube limits'*

  If full kV range is not available, check *'Tube limit'* settings.

- **Exposure data I [mA]:** range = 0.1...2000 mA

  Depending on the generator version, tube type, focal spot, selected technique and all reduction factors: This value can be a master or slave value.
  The result of a [mA]*[ms] multiplication must always be >= 0.5 mAs, otherwise error 00L$ appears.
  If full mA range is not available, check *'Tube limit'* settings or all other reduction tables.
- **Exposure data Q [mAs]:** range = 0.5...1000 mAs (generally limited at 850 mAs)

  Depending on the tube type, focal spot, selected technique and all reduction factors: This value can be a master or slave value.

  If full mAs range is not available, check *'Tube limit'* settings or all other reduction tables.
- **Exposure data t [ms]:** range = 1...16000 ms

  Depending on the tube type, focal spot, selected technique and all reduction factors: This value can be a master or slave value.
  The result of a [mA]*[ms] multiplication must always be >= 0.5 mAs, otherwise error 00L$ appears.

  If full range is not available, check *'Tube limit'* settings or all other reduction tables.

- **Exposure data density (6% steps):** range = -8...+8 density steps at 6%

  Depending on which step rate has been programmed at *'RGDV Data Set B'*, explanation see **[1] page 25**.

*** If APR with AEC are associated to a certain Film-Screen-Combination the basic density value of the FSC appears as a **zero**. This **zero** - value is the base density value which has been adjusted to the customers taste.
There are organs which work fine with the basic **zero** density, but others require e.g. a **zero**-2 or zero+3 correction. SCP and MedioCP are based on 12% steps for every +/-1 correction, so should the Optimus be programmed at *'RGDVx Data Set B'*. For every +/-1 12% step two +/-6% steps have to be programmed.

- **Film screen comb.:** Offers all available FSC names programmed to the *'Data Set'*s of a chamber assigned to the RGDV of the selected APR.

  def 1 = default, no FSC programmed yet.

Since Release 3 predefined APR data sets can be programmed with the FSC name = *'Abbreviation'*. If the *'Abbreviation'* string and the name in the APR data set is identical, the FSC will be associated to the APR data set.
If no name is given in the default APR data set the **Recommended Dose µGy** value of the individual APR data set will determine the assignment of the APR to the FSC Data Set which has the closest ***'Dose of FSC [µGy/V]'*** value.
!! The **Recommended Dose µGy** value cannot be seen in this screen via XRGSCOPE **!!**
!! It is only possible with the **APRMAN**ager.

*** Most of the predefined APR data sets from the installation disk are programmed for a 400 speed system (Recommended Dose: 2.5 µGy). If these are taken all organ dependent mAs values have to be adapted to the local film speed systems (doubled for 200 speed systems, divided by 2 for 800 speed systems).

- **[P]Tomo Number:**
  1 = default
  1...8 = via *'Release circuit adaptation unit'* 1WA or 2WA
  1...16 = *'Bucky Ctrl. 1/Dig. Diag.'* Bucky TH / TH2 and Digital Diagnost via CAN

  Option **Automatic Input of Tomo Times** 9890 000 0222x (see STAMMKARTE) must be present. If no tomo unit is present: **ignore**.

Decade systems:
Active if programmed at *'RGDVx Data Set A + B'*, *'RGDV Interface Assignments'* and *'Tomo Time'* for the programmed *'Release circuit adaptation unit'*. Then 8 tomo numbers are available for non-CAN systems.

*** If tomo APRT's are programmed using option **Automatic input of tomo times**: Select every APRT once. For a very short time the default time of an APRT can be seen at the desk, then the tomo time contact might override the default time. This time must be saved using the desk save function: push and hold the **RESET** labeled button **+ active APRT**. Now the programmed tomo time 1...8 is copied and saved at the APRT data set. If it is not saved then the default APRT time will come up again if the APRT is pushed a second time or if an APRT with the same tomo time is selected.
The tomo time input only reacts to a high >> low transition of the time contact input.

- If tomo is programmed at *'RGDV Data Set A + B'* it is not possible to change the exposure time at the desk. If APRT with the same tomo trajectory have to be corrected time dependent then an APRT with another tomo trajectory has to be selected. Afterwards select the APRT which has to be modified to get the high >> low time input response.
- It might happen that three tomo times can be seen at the desk after pushing an APRT button: At first the APR time is displayed. The second time might be tomo time number 1, as long as all time input contacts of the tomo stand are open. If then any tomo time contact is closed, the status change will cause the display of the programmed tomo time

CAN systems:
Active if programmed at *'RGDVx Data Set A + B'* for CAN systems:
Bucky TH, TH2, Digital Diagnost ("**<**" marked not for DiDi) systems with TOMO option provide 16 tomo sweeps:

tomo #		sweep	tomo #		sweep
Bucky	Optimus		Bucky	Optimus	
0	1	8º / 0.8s	8	9	30º / 1s
1	2	8º / 1s	9	10	30º / 2s
2	3	8º / 2s	10<	11<	30º / 3s
3	4	20º / 0.8s	11<	12<	30º / 4s
4	5	20º / 1s	12	13	40º / 1.2s
5	6	20º / 2s	13	14	40º / 2s
6<	7<	20º / 3s	14<	15<	40º / 3s
7	8	30º / 0.8s	15<	16<	40º / 4s

Tomo via Bucky controller:
If the default programmed tomo times in the APR data set are different to the tomo times sent by the bucky system the default APR time appears for a very short moment, then the time will be overridden by the controller message. If so, use the save function of the desk to save the proper tomo time in the APR data set.

- **[P]** **Spectral Filter:**

Gives a selection of the three filter types of the GALILEO collimator BuckyTH, TH2, Digital Diagnost, Thoravision:

no filter
2 mm AL
0.1 mm CU + 1 mm Al
0.2 mm CU + 1 mm Al

- **[P]** **Fluoroscopy curve:**

One out of the 20 *'Fluoroscopy curves'* (the ones which have been loaded with default data sets can) be selected.

- **Inquire APR Assignments** INQ_APR

OPTIMUS provides memory for 1024 APR. Once activated an APR data set gets an APR-#. These #s are given without any special system (it is more ore less random). If a certain APR-# is known, typed in and transmitted with <F2>, the window coming up gives the APR name, the RGDV and menu to which it is assigned to (blank in case of none), the page, line and column of its position.
If an APR-# is typed in which is not assigned to any RGDV the location fields (RGDV, menu, submenu, page etc.) are empty, the name might be [### APR name ###] or any old name of an APR which has already been deassigned.
To get the APR-#, just select any APR button at the desk. Then use *'Select APR Data Set'*. (It is not possible with the default **Test APR**.)

- **RGDV related Assignments**

  - **RGDV 1** ... 8

    - **Predefined Assignments**

The **Load Data from Disk** window offers all predefined APR data sets of the installation disk or other predefined files (or use APRMAN.EXE to create customized APR data files).

The name of these files is A*******.TDL, details:

AR_EMPTY	for generators without APR option 9890 000 0282x
ATS..V	BuckyTS with Vario focus RO17/50, SRO25/50, SRO33/100
AT..V9	BuckyTS with Vario focus SRO09/50
CO	Cosmos
DS	DSI, easyDiagnost
D15/76/96	R/F systems
F	fluoro stands DSI spotfilm
SI	easyDiagnost, D15
TR	Trauma
TS	BuckyTS
V	Vario focus RO17/50, SRO25/50, SRO33/100
V9	Vario focus SRO09/50

...DE(U)	German
...EN(G)	English
...ES(P)	Spanish
...FR(A)	French

The files may contain e.g. data sets in a window **Available Examination Unit Type**:

BUCKY GR	Bucky table APR under a **group** (menu) layer
BUCKY PA	Bucky table APR **paging** (scroll through the APR pages)
WALLSTD GR	Bucky wallstand group
WALLSTD PA	Bucky wallstand paging
FREE GR	Free technique (non-AEC) group
FREE PA	Free technique (non-AEC) paging
TOMO LT/HDH	tomography group
TOMO LIN/PA	Tomography paging

System names are also mentioned in the offered data sets.

After the end of the transmission from the PC to the generator "**waiting**" will appear on the PC screen. Now the generator is calculating data with the individual installation parameters (generator power, tube type, technique etc.). The generator **must not** be reset before "**waiting**" disappears, APR which have not yet been calculated at that moment are lost.

Individual RGDV related backup files (APR_BAKx.TDL, x = 1...8, see *'Accept'* + *'Backup'*) can also be loaded to the generator with the same *'Predefined Assignment'* function.

It is possible to load all RGDV with predefined APR data sets and make one generator reset at the end of all loading procedures. After every reset all newly loaded APR and menus

appear at the desk.
It is not possible to load a second data set on top of an existing data set. The old RGDV menu/APR structure has to be erased before with *'Delete Menu'*.

With the XRGSCOPE - *'File'* option one can use the editor to modify the predefined APR data sets or backup data sets (e.g. to change all APR to large filament in case of a single filament tube).
This is easier and faster as if every APR will be selected at the desk with *'Select APR'* followed by the *'Change APR'*. One advantage is that this can be done offline while the customer can use the system.
The handling is easy, is almost similar to the *'Change APR'* screen online with the generator. After modification the data set has to be saved with <F3>, the filename could be the same or any other.
Disadvantage: Only data sets with up to 50 APR can be modified. There is no way to add or erase APR.

!! It is much easier, faster and more convenient using APRMANager APRMAN.EXE.
(Info: APRMAN is using some of the manual XRGSCOPE modes under the WINxx platform).

- **Manual Assignment**

  - **APR Assignment**

    - **Select Menu** SEL_MENU

      The menu name field is as long as the longest menu name. If the field is only two digits long, no character is visible and only one field is displayed after <ENTER> then there is no menu.
      If no menu structure exists, proceed directly to *'Assign APR'*.
      If APR's shall be in a menu structure, assign this/these before in *'Menu Assignment'*.

      If an APR shall be added to a menu it has to be selected first. Transmit this window with <F2> after selection.

    - **Assign APR** ASS_APR

      An APR position has to be opened first, after a cold/warm reset the new open position can be selected at the control desk to be modified thereafter (see *'APR Data Set'*).

      APR:
      The window will offer either **### APR name ###**, which is the default data set or, if there have already been other APR, some previous names of deassigned APR's (see *'APR Deassign'*).
      Page No.:
      Line No.:
      Column No.:
      It indicates (automatically) the next position where it will be loaded to:
      page, line and column.
      The order of APR assignment on a page is always like this:

1	5 (5) [-] {-}
2	6 (6) [5] {5}
3	7 (7) [6] {6}
4	8 (-) [7] {-}

straight numbers 1...8 : APR without menu, paging, RAD RGDV
numbers in ( ) brackets : APR with menu/submenu structure, RAD RGDV
numbers in [ ] brackets : APR without menu, paging, fluoro RGDV
numbers in { } brackets : APR with menu/submenu structure, fluoro RGDV

    - If APR's are programmed to a menu/submenu structure, position column 2 line 4 indicates "menu" to come back to the menu screen

- On every page of a fluoro RGDV column 2 line 1 position is used to display the fluoro parameters (kV, mA. fluoro time), it cannot be used for assignments

  Any position can be typed in. If the position is already occupied, an error will come up.
  If only one APR at position column 2 line 3 exists at a menu structure, the next APR position will be on the next page, even if all other positions on this page are free. The automatically given position can be changed to fill up empty positions.
  Do not assign an APR at position column 2 line 4 at a menu structure or to column 2 line 1 at a fluoro RGDV, it will be transmitted to nowhere.

- **APR Deassign**

  - **Select Menu**

    The menu name field is as long as the longest menu name. If the field is only two digits long and only one field is displayed after <ENTER> there is no menu.
    If an APR shall be removed from a menu structure this menu has to be selected first.
    If no menu structure exists, proceed directly to *'Deassign APR'*.
  - **Deassign APR** DEASS_AP

    'Deassign APR' gives a selection of the APR programmed at a menu or a paging structure (it does not matter if there are empty fields in-between the APR).
    Deassigned APR are not totally lost. There is access to deassigned APR at *'Assign APR'* if the amount of APR is <= 500 to get them revived .
    Deassigned APR can still be seen at the desk if no generator warm reset was made after deassignment, but they cannot be used anymore.

- **Menu Assignment**

  - **Select Menu** SELNEMEN

    There are structures possible with a menu layer first and a second (up to 10) submenu layer.
    Creating submenu structures: First assign the main menus at *'Assign Menu'*. Then *'Select Menu'* and program the submenu names at the main menu with *'Assign Menu'*.

    !!! At least one APR must be programmed to one of the lowest menu or submenu layer to have the structure fixed.
    If once an APR is programmed to a menu there is no further submenu layer possible.
    The *'Select Menu'* name field is as long as the longest available menu name. If no menu is available there will be the message **The requested table is empty**.

  - **Assign Menu** ASS_MENU

    This function can be used to assign menus to an empty RGDV. It can also be used to add a menu to an existing menu structure (in the same layer) or to create / add submenus.
    Menus cannot be assigned if a paging structure with APR only is programmed or within an APR layer.
    Submenus cannot be assigned at least one APR exists at a menu. In this case no menus are offered at *'Select Menu'*.

    Menu Name:

Note: Since Bucky controller release 5.x for BuckyTH2 and also for Digital Diagnost a "=" character must be at the end of the APR name string to get a system ready for grid used RGDV / APR. Menus with such APR should also have this "=" character to indicate the use of the grid (especially if menus without grid also exist).
APR for RGDV 1+2+3 with **Inalfa** trays must always have the "=".
APR for **ACL4** trays with removable grid must have the "=" when the grid shall be used
and **no "="** when the **grid** shall **not be used** (removed from the tray to get ready) for

application reasons.

Page No.:
Line No.:
Column No.:

It indicates (automatically) the position where it will be loaded to:
page, line and column
The order of menu assignment on a page is always like this:

•	1	5 (5) [-] {-}
•	2	6 (6) [5] {5}
•	3	7 (7) [6] {6}
•	4	8 (-) [7] {-}

straight numbers 1...8 : straight menu layer **RAD** RGDV
numbers in ( ) brackets : menu with submenu structure, **RAD** RGDV
numbers in [ ] brackets : straight menu layer, **fluoro** RGDV
numbers in { } brackets : menu with submenu structure, **fluoro** RGDV

- If menus are programmed to a submenu structure, position column 2 line 4 indicates "menu" to come back to the previous menu screen
- On every page of a fluoro RGDV column 2 line 1 position is used to display the fluoro parameters (kV, mA. fluoro time) and cannot be used for assignments

!! The automatic positioning unfortunately also takes the position which is occupied
!! by the fluoro kV/mA and time label.

Any position can be typed in. If the position is already occupied, an error will come up. If only one menu at position column 2 line 3 exists at a menu structure, the next menu position will be on the next page, even if all other positions on this page are free. The automatically given position can be changed to fill up empty positions.
Do not assign a menu at position column 2 line 4 at a menu structure or to column 2 line 1at a fluoro RGDV, it will be transmitted to nowhere.

- **Delete Menu** DEL_MENU

This function allows to delete the selected menu including the whole structure under it. It can be an APR layer only or with submenus including all APR's.
The function offers all menus of a RGDV including an empty field on top. If the empty field will be selected and transmitted with <F2> the complete menu/submenu/APR structure will be erased. After generator reset "**test APR**" will appear at the desk. This function should be used to clear a RGDV before new predefined APR data sets are loaded or the *'Accept'* >> *'Restore'* (to reload backup files) function is used.

- **Move Menu** MOVEMENU

Menus or submenus can be moved within its layer to a free position (column and line), which has to be defined before. Moving menus to other RGDV's is not possible. Use **APRMAN**ager for a more convenient, faster and easier maintenance.

- **Rename Menu** REN_MENU

The menu name can be changed into everything desired (special characters see doc INSTALLATION).

- **External APR Assignments**

- **Device Interface 1** only possible, if *'Release circuit adaptation unit'* is programmed as
EXT_APR1 1WA unit (jumper W1/W2/W3 open at WA backpanel)

1	2
5	6
7	8

The *'RGDV key 1/2'* positions can be programmed with any of the active RGDV's. Six APR of every active RGDV can be assigned to the six buttons 3...8. To get the *'APR key'* numbers use *'Select APR'*.
The APR numbers must be entered at the RGDV # where they are assigned to. The two programmed RGDV keys appear at all RGDV screens.
If an assigned RGDV and/or an assigned APR is selected at the control desk, the RGDV/APR button will light up at the external APR module and vice versa.

- **Device Interface 2** only possible, if *'Release circuit adaptation unit'* is programmed as
  EXT_APR2 2WA unit (jumper W1closed, W2/W3 open at WA backpanel)

  APR key 1...8 **(0 no APR):** positions 1..8 = keys 1..8 (see page 32)

  8 APR of each active RGDV can be assigned to the 8 APR keys (>> max 64 !!).
  It is recommended to use one RGDV only.
  If an assigned APR is selected at the control desk, the APR button will light up at the external APR module and vice versa.

- **Device Interface 3** only possible, if *'Release circuit adaptation unit'* is programmed as
  EXT_APR3 1WB unit (jumpers W1/W3 open, W2 closed at WB backpanel)

  With the **RGDV key 1** and **RGDV key 2** assignment the RGDV remote switch over inputs WB X21 pin 1 and 2 will be activated. The selected RGDV must get a low signal from the R/F controller, while the other RGDV signal must go high.

  !! Both keys **must** be programmed.

  8 APR of each activated RGDV can be assigned to the 8 APR keys (e.g. SCOPO) (max 64 !!).
  It is recommended to use one RGDV only.
  If an assigned APR is selected at the control desk, the APR button will light up in the external APR module and vice versa.

- **APR modifiable by User** APR_MOD

  Yes = All data which can be overridden at the desk can be saved:
  - Push **and hold** the "RESET" labeled button
  - push the highlighted (overridden) APR button
  - the asterisk indicating overriding disappears.

  No = The save function after overriding is disabled, should be programmed if the MENU/APR structure is stable after a certain time after installation or if there are 'gamblers' on site

  Note: In combination with *'Bucky Ctrl. 1/Dig. Diag.'* :
  If *'no'* is set one can see the following effect when carrying out the save function:
  Generator desk and the control handle jump to and display the APR which is assigned to **APR Program 1** at the control handle of the BDTH or BDTH2, Digital Diagnost does not have this effect as the SUN holds the APR address.

Optimus (XRG90) >> Adjust

- **Adjust**

  - **Tube Adaptation**

    The tube should be properly conditioned before starting the adaptation procedure.
    Conditioning procedure see doc INSTALLATION.

    Note for all CAN connected systems:
    Since release 5.x of Bucky controller
    - **BuckyTH2**
    - **Bucky unit easyDiagnost**

    or if connected to a
    - **Digital Diagnost** :

    Remove CAN bus connections EZX42-1 and 43-1 and signal bus connection EZX23 from the backpanel. After turn-on it might take about 2 minutes for the generator to energize ENK1 indicating that the generator is ready.

    Select free cassette auxilary
    RGDV 4 at **BuckyTH2** and **Digital Diagnost**
    or
    RGDV 8 Bucky unit easyDiagnost
    RGDV4 or RGDV8 *'Data Set A'* has to be modified, only these settings have to be changed:

    - Syncmaster present **= No**
    - Mounted radiographical controller **= none**

    Transmit the *'Data Set A'* screen with <F2> and push the free cassette RGDV button, then the modified data are valid (a generator warm start is not required).

    The generator should now be in ready condition RGDV free cassette.

    Al other systems should use a non-grid auxilary to carry out adaptation.

    Tube adaptation is an automatic process which includes the
    1) measurement of the mA offset value that is caused by
       - the kV measuring circuit
       - the emission current feedback circuit (VCO)
    2) measurement of the individual standby filament current (based on 100uA)
    3) kV dependent filament / emission current characteristic
    4) positive and negative boost adaptation where the inertia of the filament with respect to heating up and cooling down is registered (more information see doc FAULTFINDING).

    After selection of *'Tube Adaptation'* with <ENTER> a screen asks to wait 20 seconds after the screen coming up thereafter has been sent with <TRANSMIT> or <F2>.

    Press <ENTER> and select:

    Tube: **1st Tube**
    2nd Tube
    3rd Tube

    Focus: **small**
    medium a tube with a (third) medium filament does not exist yet, it is **not** VARIOfocus
    large

    After <TRANSMIT> the green ready disappears from the desk for 20 seconds. The "**Test**" display on the right side of the major exposure parameter indicating a non-adapted focus will change to "**Adap**". With adapted tubes parameters like "film-screen-combinations" or "xxx ms" will disappear and will also be replaced by a "**Adap**" during **re-**adaptation.

Ready returns with a first data set **40kV 0.00mAs** to measure the mA measuring circuit offset.
- Start the adaptation procedure by pressing the hand-switch in PREP and EXP position continuously.
- The anode will be accelerated and braked several times during the entire adaptation process.

After about 30 sec after the fist 40kV 0.00mAs exposure **40kV 1.5mAs** will be switched for 6 seconds to measure the individual standby filament current.
After another 20..30 seconds exposures with different kV stages are switched (about 120 / filament), there will be a little pause at the end of this process.
4 min after start of adaptation the boost adaptation takes place. One exposure is for the positive boost to measure the boost up time, a second one (which is the last exposure of adap) for the negative boost to measure the cooling time. The tube will brake the last time, a beep at the PC and a window on the screen will ask to reset the generator.
There is no exposure end beep during the entire adaptation procedure.
During the adaptation it might happen, that the procedure stops for a while. The red light of the temperature traffic light might turn on and warning entries 00BV are logged. If the TTS (Tube Temperature Supervision) detects a temperature in a critical range it will stop adaptation for a while to keep adaptation always at a 100% load range.

After adaptation followed by a generator reset all techniques are available and "**Test**" disappears.

AEC, **AECF**, **TDC**, **kV-mAs**, **kV-mA-ms**, **kV-mAs--ms** techniques and **Fluoro** (small focus only) are not available as long as the filaments are not adapted.

VARIOfocus as a "calculated" virtual focus requires that small **and** large focus are adapted. APR using VARIOfocus cannot be selected as long as both, small and large, are not adapted.

- **CAN Auto Configuration**

  Start function: Update Generator Config:

  <OK> gives the command for CU to scan on the internal generator CAN bus and update the generator CAN member list (assign / de-assign units on the list).
  Minimum configuration of an OPTIMUS (see also *'Faultfind - Power ON Results - Internal CAN Configuration'*:
  FU_mA (EZ119), **FU_kV** (EZ130), **FU_CU** (EZ139), **FU_CIE** (EZ150).
  If now an optional **F**unction **U**nit shall be added (e.g. FU_ADAP A = 1WA = PCB EWA102) this command must be given to register this PCB on the CU CAN list.
  If a generator is getting a new (empty memory) PCB CU or the NVRAM has to be erased for any reason CU updates the member list during the very first turn-on itself.

  <CANCEL> or <ESC> nothing changes

- **Area Exposure Product** Displayed at the control desk only if option (9890 000 0256x, see STAMMKARTE) present (see *'Faultfind - Power ON Results - Options'*) with GALILEO collimator if *'Bucky Ctrl. 1/Dig. Diag.'* or *'Thoravision'* set.

  TH + TH2: Dose value display of all exposures of a patient, must be reset with next patient.
  Thoravision: The dose value is not displayed at the control desk, as the system controller takes the value and resets the value afterwards with the command **next patient**. The dose value will be displayed on the images.
  Digital Diagnost: The dose value of the last exposure will remain on the desk until the next exposure will be started.

  - **Specific Yield of Tubes**

    - **Specific Yield of Tube 1**...**3** SPEYIELD

      Procedure to measure and modify the specific tube yield see doc ADJUSTMENTS. The default yield data table is on the installation disk: **RE_YIEL.TDL**.

    - **Add Filter Correction Table** to Adjust deviations of the default filter correction tables of the (additional) homogenous GALILEO collimator filters

FIL_CORR
- **2 mm AL** The default data table is on the installation disk: **RE_2AL.TDL**.
- **1 mm AL + 0.1 mm CU** The default data table is on the installation disk: **RE_01CU.TDL**.
- **1 mm AL + 0.2 mm CU** The default data table is on the installation disk: **RE_02CU.TDL**.

- **Wedge Filter Correction Tables** to adjust deviations of the default filter correction tables of the GALILEO wedge filters (not yet available)

WED_FILT
- **Wedge 1** The default data table is on the installation disk: **RE_WED1.TDL**.
- **Wedge 2** The default data table is on the installation disk: **RE_WED2.TDL**.
- **Finger Wedge** The default data table is on the installation disk: **REF_FING.TDL**.

- **Dose Rate Control** >hardkey<

  - **TDC Amplimat** TDCAMPLI

    p gain factor (def.50): range = 0...100 default = 50
    i gain factor (def. 8): range = 1...100 default = 8
    d gain factor (def. 5): range = 1...100 default = 5
    min sample time (def.40ms) [ms]: range = 25...60ms default = 40ms
    mul. with gain factor 0.625...1.5 (def.1): range = 0.625...1.5 default = 1

  - **Amplification gain** TDCAMGAI

    - **TDC** gain factor tomo density control

      gain factor 0.625...1.5 (def.1): range = 0.625...1.5 default = 1

    - **CONT** gain factor continuous fluoroscopy CONTGAIN

      gain factor 0.5...2 (def.1): range = 0.5...2 default = 1

    - **CONT kV mA manual** CONTKVMA

      LOCK IN: **LOCK** = for dose adjustment procedures, this function replaces the kV and mA potmeters
      automatically disabled after reset
      !!! If no link is inserted at 1WB X12:07 (DR_FL_LO_1) to :10 (GND2) the screen will be in *'UNLOCK'* condition when the screen is called again.

      UNLOCK = default or after soft reset or if no link is in at 1WB X12:07 (DR_FL_LO_1) to :10 (GND2)

      U[kV]: range = 0...200 kV default = 70 kV
      I[mA]: range = 0...2000 mA default = 1 mA
      the value **must not** be **< 0.1mA** to prevent malfunctions of the generator
      DR set [µGy/s]: range = 0.001...2.0 >> the '*****' appearing in these two fields
      DR measured [µGy/s]: range = 0.001...2.0 >> have to be replaced by a dose value

      >> Procedure for II input dose adjustments:
      set *'LOCK IN'* to *'LOCK'*, type in kV and mA values, type in an identical DR (dose rate) value at both fields (e.g. 0.3). Switch on fluoro, type in the measured DR value, <TRANSMIT> the data screen, open the screen again - it will display a new mA value to achieve the required dose rate

  - **Boost Adaptation** >hardkey<
    Boost adaptation is part of the automatic *'Tube adaptation'* procedure. If it

might be necessary (no reason known yet) this function can be used, normally: **ignore**.

Optimus (XRG90) >> Accept

- **Backup** >hardkey<
  - **RGDV related Assignments**

    RGDV 1...**8**

    APR Assignments After **Reading** (spinning bar) the PC offers the default backup name **Backup File Name: APR_BAK1**...8**.TDL**.
    The default name can be changed into any other (up to 8 digit) file name.
    The path from which XRGSCOPE has been started on the hard disk will automatically be taken into account.
    It is also possible to type **A:\filename** <ENTER> to load the backup file directly to a floppy disk.

  - **CU Complete**

    The default backup name **Backup File Name: CUBACKUP.TDL** (or A:\filename <ENTER>) can be changed into any other (up to 8 digit) file name (e.g. **CU97xxxx**.TDL representing the generator serial number). A disk space of 700 kByte is required. It takes about 8...15 minutes to save the data to the floppy / hard disk.
    The path (from which XRGSCOPE has been started on the hard disk) will automatically be taken into account.
    It is also possible to type **A:\filename** <ENTER> to load the backup file directly to a floppy disk.

- **Restore** >hardkey<
  - **RGDV related Assignments**

    RGDV1...**8**

    APR Assignments The path (from which XRGSCOPE has been started on the hard disk) will automatically be taken into account
    or type in either **A:\filename** <ENTER> or just **A:** <ENTER>, <TAB> and select a file with the cursor up/down buttons.

    Load Data from Disk: will offer the default file name **APR_BAK1**...8.

  - **CU Complete**

    Load Data from Disk offers the default **File Name: CUBACKUP.TDL**
    (taking the path from which XRGSCOPE has been started automatically into account)
    or type in either **A:\filename** <ENTER> or just **A:** <ENTER>, <TAB> and select a file with the cursor up/down buttons.

    It takes about 15-30 minutes to restore the data (PC type dependent). If the spinning bar during the loading procedure seem to turn very slowly then stop the procedure. Type **<ALT> x** to leave the XRGSCOPE program and type in the following command in DOS or WIN: **XRGSCOPE D=5** , the smallest value should be 1 for a PC processor with a low speed.

    !!! Date and Time must be set after restore is finished with a new PCB CU or after the NVRAM has been erased by pulling the battery jumper. **!!!**

- **Inspect**

- **Tube Statistic**

  - **Tube 1**...3 **Statistic** TUBE_STA

    - **Show Tube Statistic**

      reset date: [DD.MM.YY]
      = date of the last reset (initial, tube exchange)
      last update: [DD.MM.YY]
      = date of the last table entry
      preparation time large focus [s]: [ ]
      preparation time small focus [s]: [ ]
      preparation time vario focus [s]: [ ]
      preparation counter large focus: [ ]
      preparation counter small focus: [ ]
      preparation counter vario focus: [ ]
      fluoro time [min]: [ ]
      fluoro counter: [ ]
      exposure counter large focus: [ ]
      exposure counter small focus: [ ]
      exposure counter vario focus: [ ]
      overload exposure counter large focus: [ ]
      overload exposure counter small focus: [ ]
      overload exposure counter vario focus: [ ]

    - **Reset Tube Statistic**

      A screen **"Start function: reset tube statistic"** comes up. Hit <ENTER> to reset the tube statistic data table.
      This procedure should be carried out after tube exchange.

  - **Generator Statistic**

    for future use [s]: to count the switch on time, not yet implemented

  - **Type of Tube 1**...**3** TUBETYPE

    Tube name + housing type as programmed from the tube data file.
    Empty field: no tube programmed.

Optimus (XRG90) >> Faultfind >hardkey<

- **Power ON Results**

  - **Options** OPTIONS

    This screen displays all options programmed in the function key EZ139 D38 (compare with STAMMKARTE at the cover of the frontal kV converter and add-on STAMMKARTE updates).

Power Class (kW):	[xx]	xx = 50 / 65 / 80 possible
*****:	[yes/no]	not used
RF:	[yes/no]	Optimus R/F hardware, all Bucky functions possible
Bucky:	[yes/no]	Optimus RAD hardware, no fluoro or fluoro upgrade possible
TDC:	[yes/no]	tomo density control
AEC:	[yes/no]	automatic exposure control
APR disabled:	[yes/no]	yes = no APR visible at control desk
*****:	[yes/no]	not used
*****:	[yes/no]	not used
*****:	[yes/no]	not used
Vario Focus:	[yes/no]	only RO16/48, RO17/50, SRO09/51, SRO25/50, SRO33/100
External Tomo Time:	[yes/no]	via system CAN or WA units
OEM:	[yes/no]	not used
Area Exposure Product:	[yes/no]	only with Galileo collimator
Tube Protection:	[yes/no]	if no exposures can be switched with red tube heat indicator on, overload exposure counter active
PDO:	[yes/no]	patient data organizer
*****:	[yes/no]	not used

  - **Internal CAN Configuration** CANCONFI

    This screen displays the actual status of the assigned members on the internal generator CAN. The CU as main controller of the generator is not part of this list.

    b = basic unit, **must** be in
    o = option

FU kV:		[ ]	**b**	**kV_control EZ130**
FU mA a:	[ ]		**b**	**mA_control EZ119**
FU mA b:		[ ]	o	2nd mA_control, not available
FU mA c:	[ ]		o	3rd mA_control, not available
FU mA d:		[ ]	o	4th mA_control, not available
FU CIE:		[ ]	**b**	**C**entral **I**nterface **E**xtension = **Basic interface EZ150**
FU HI a:		[ ]	o	**H**uman **I**nterface = **operating desk CPU C300**
FU HI b:		[ ]	o	2nd operating panel, not available
FU RC a:		[ ]	o	high speed **Rotor Control EY100**
FU RC b:		[ ]	o	2nd high speed rotor control, not available
FU RC c:		[ ]	o	3rd high speed rotor control, not available
FU AD a(1WA):	[ ]		o	adapter for 4 aux. units WA (Bucky/Tomo) **1WA102**
FU AD b(2WA):		[ ]	o	adapter for 4 aux. units WA (Bucky/Tomo) **2WA102**
FU AD c(1WB):		[ ]	o	adapter for 4 aux. units WB (R/F and Bucky) **1WB102**
FU AD d(2WB):		[ ]	o	adapter for 4 aux. units WB (R/F and Bucky), not available
FU MDO:		[ ]	o	monitor data overlay, not available

[**01**]	=	no response from basic unit
[**2**]	=	unit (basic and optional) on CAN member list and ok
[**F0**]	=	optional unit in CAN member list, but no response during turn-on
[**FF**]	=	optional unit not present, FF also appears if a unit is physically installed but has not yet been assigned

  - **SW/HW – Versions** HWSWVERS

This screen displays the actual firmware versions **R**elease**, V**ersion (don't care) and **L**evel.
For PCB **C**entral **U**nit it also displays the hardware version (must be **2** for Release 3.x).

CU APPL SW:	[**R3**V1**L5**]	4512 114 20835	
CU BOOT SW:	[**R3**V1**L1**]	4512 113 20731	
FU kV:	[**R3**V1**L2**]	4512 113 20132	as an example for Optimus RAD
FU mA a:	[**R1**V1**L2**]	4512 113 20212	
FU mA b:	[- - - - -]		
FU mA c:	[- - - - -]		
FU mA d:	[- - - - -]		
FU CIE:	[**R1**V1**L1**]	4512 113 20311	as standard version
FU HI a:	[**R2**V1**L5**]	4512 113 20525	
FU HI b:	[- - - - -]		
FU RC a:	[**R2V1L3**]	4512 113 22323	with the new RoCo 4512 104 71421/461
FU RC b:	[- - - - -]		
FU RC c:	[- - - - -]		
FU AD a(1WA):	[**R1**V1**L1**]	4512 113 20611	
FU AD b(2WA):	[**R1**V1**L1**]	4512 113 20611	
FU AD c(1WB):	[**R1**V1**L1**]	4512 113 20611	
FU AD d(2WB):	[- - - - -]		
FU MDO:	[- - - - -]		
CU HW:	[**2**]		

- **Logging Table**

  - **Error Log** ER99XXXX

    - **Error Log Index** gives an overview of the events logged in the CU NVRAM

      Depending on the free memory of the PC (no matter if it runs with DOS or any WINxx) the error log index might appear as a table in which one can go up/down with the cursor buttons or
      with just one single error, the frame indicates "Error Log Index 1/50". With the <TAB> button one can jump to the right end of the individual screen, with the <page up/down> keys one can step through the error index list, the actual index number will also change to e.g. 12/50.

      Index: [ ]

      Max 50 events can be logged. The last event is always at the highest index number. If all 50 lines are filled, line 50 will log the last event and the oldest event (line 1) disappears.
      The last entry will always be "00S*" if the first action after log-in is checking the error log index. "00S*" indicates that a PC log-in has taken place, no matter if XRGSCOPE or APRMAN was used.

      Code: [ ]

      Displays the 4 digit code.
      - The first two digits represent the error source (**F**unction **U**nit number, HEX format, FU list see doc FAULTFINDING),
      - the last two digits the event mailed by the unit.

      Date of Error: [ ]

      Event entries should have a regular date and time format.
      If the date and time column also contains any letters,
      the clock has not been set
      - after the very first switch on
      - after PCB CU exchange
      - after NVRAM = CMOS erase of CU
      - possibly after *'Restore'* of *'CU Complete'*

Error Explanation: [ ]

Gives a brief explanation of an event.

- **Select Error Detail** SELERDET

  Index: [ ]

  After looking through the *'Error Log Index'* list enter the index number of an event to get the details. (The last index number is automatically in the input field). Transmit with <F2>.

- **Error Log Detail** ER_CU_1, ER_CU_2, ER_KV_1...ER_KV_5, ER_MA_1...ER_MA_6

  Not every function unit provides detailed event logs. If event source is not CU, kV (see *'FU-kV'*) or mA (see *'FU-mA'*), "**FU not supported**" will be displayed.

  - **Error Detail of CU**

    - **Error Info** to be continued
    - **Program Trace**

  - **Error Log Clear**

    Start function: Clear Error Log Once sent with <OK> all entries are erased.

- **X-Ray Log**

  - **Tube Temperature Supervision Logging**

    - **Tube Temperature Supervision Temperature Log** TTS1TEMP TTS2TEMP

      The tube temperatures are supervised by the TTS calculation model. Every second the temperatures are re-calculated and updated in this table. Overload flags (see **part: 23456**) are tube and housing type dependent. Tables disappear with switch off, but actual temperatures will be calculated and updated during switch on or warm start.
      All temperatures should be at 20ºC (basic value) after a long switch-off period.

      04/ X-SEGMENT: Tube Temperature Table

		temperature in degrees centigrade					overload at
time	**tube**	**T(2)**	**T(3)**	**T(4)**	**T(5)**	**T(6)**	**part: 23456**
8193	1	20.0	20.0	20.0	20.00	20.000	0 0 1 0 0 0 0 0 (see table)

      (condition after turn-on, long time no working)

      time time table in seconds
      tube tube number (1...3)
      T(2) focal spot temperature
      T(3) focal track temperature (outer anode circuit)
      T(4) anode disk temperature (inner anode circuit)
      T(5) rotor temperature
      T(6) oil temperature

0	**0**	**1**	**0**	**0**	**0**	**0**	**0**
yellow	red		T(2)	T(3)	T(4)	T(5)	T(6)
traffic light condition: green = 0 0 green + yellow = 0 0 yellow = 1 0 yellow + red = 1 1 red = 1 1		1 = standby 0 = exposure	0 = temperature value within the max limit				
			1 = temperature value increased max limit				

    - **Tube Temperature Supervision Load Log** TTSLOAD TUBELO_2

This Tube Load Table displays all loads to the tube and housing. The table disappears after switch off or warm start.

time	indicates at which second the event has been logged after turn-on
tube	tube number (1...3)
tube disk energy	[Ws] parameters
peak load	[W] max peak load
rotor energy	[Ws] acceleration and brake energy in one package
focus	filament used for the exposure VARIO focus is displayed as large filament at a ratio of 20%, 35% and 50% of small focus, as small with 65% and 80% of small focus

- **Tube Temperature Supervision Error Log**

  to be continued

- **Dose Rate Control Logging**

  - **Read Actual Status** RE_AC_S1 RE_AC_S2 RE_AC_S3

    selected mode: techniques: AEC, TDC, manual = all non-AEC
    time measured [ms]: all techniques
    last I [mA]: automatic techniques only
    last U [kV]: automatic techniques only
    dose relative [%]: automatic techniques only
    dose offset: automatic techniques only
    last dose measured: automatic techniques only
    LOCK IN state:
    DRL (dose rate limitation) state:

  - **None Automatic Technique Calculation** NONAEC_1 NONAEC_2

    U nominal [kV]:
    I nominal [mA]:
    t nominal [ms]:
    Always 2000ms if **Test** is displayed at the desk indicating a non-adapted focus.
    C eff ht [nF]:
    t corrected [ms]:

  - **AEC**

    - **AEC Calculation** AEC_CAL1 AEC_OR

      U nominal [kV]:
      I nominal [mA]:
      t backup [ms]:
      C eff ht [nF]:
      selected sensor:
      dose measurement input:
      film screen comb.:
      dose nominal [OD]:
      dose calculated:
      kV factor:
      U off [V]:
      t corrected [ms]:
      t lead AEC [ms]:

    - **AEC Trace**

      t sample [ms]

dose nominal
dose actual
dose rate
t dr [ms]
t esti [ms]

- **TDC**

  - **TDC Calculation** TDCCALC

    U nominal [kV] :
    I start [mA] :
    t backup [ms] :
    C eff ht [nF] :
    dose measurement input :
    film screen comb. :
    dose nominal [OD] :
    I max [mA] :
    I min [mA] :
    dose calculated [ms] :
    kV factor :
    U off [V] :
    t corrected [ms] :
    number of steps :
    time / sample [ms] :

  - **TDC Trace**

    idx
    dose nominal
    dose actual
    dose rate
    reg in
    reg out [%]
    new I [mA]

- **CONT**

  - **CONT Calculation Start Value** CONTCALC

    U start [kV] :
    I start [mA] :
    C eff ht [nF] :
    measure_int [ms] :
    max dU [kV] :

  - **CONT Calculation Curve** CO_CA_CU

    U [kV] :
    I [mA] :
    dr_abs :

  - **CONT Trace**

    act_idx :
    idx :
    delta_dose_rate :
    PID_out factor :
    dr_abs :
    new I [mA] :
    new U [kV] :

- **CU Trace** CU_TRACE

  Rel Time
  FG
  Trace Info

- **Advanced Checks**

  signal bus test: on/off \
  free1: on/off \
  free2: on/off no function implemented yet
  free3: on/off /
  free4: on/off /

- **Select Unit** >hardkey<

- **FU - mA**

  - **Program**

    - **Read Focus Limits** LF_LIMI SF_LIMI

      Window asks for Focus number. Type in focus number FU-mA (1...6):

focus number FU-mA	filament converter PCB **FU-mA EZ119**	focus number **CU EZ139** (0...8 = max 9)
1 large focus tube 1	filament circuit **2**	focus number **2**
2 small focus tube 1	filament circuit **1**	focus number **0**
3 large focus tube 2	filament circuit **2**	focus number **5**
4 small focus tube 2	filament circuit **1**	focus number **3**
5 large focus tube 3	filament circuit **2**	focus number **8**
6 small focus tube 3	filament circuit **1**	focus number **6**

      After <TRANSMIT> a data screen comes up.

      focus : see table *'focus number FU-mA'* above

      deinstall :

      Umin [kV]: minimum kV value, default 40kV for radiographic tubes, default data in tube data file, modification with *'Tube Limits'* possible, modified values appear after adaptation

      Umax [kV]: maximum kV value, default 150kV for radiographic tubes, default data in tube data file, modification with *'Tube Limits'* possible, modified values appear after adaptation

      Uiso [kV]: focus specific value, default value will be overridden after adaptation (generator version = max available emission current dependent). Uiso is the kV value, from which on the filament current can be decreased to drive always the max kV dependent emission current (with rising kV)

      Pmax [W]: maximum focus output power, default value in tube data file, value might be different (lower) after tube adaptation (e.g.SRO33/**100** with Optimus 50: Pmax after adap = 50kW instead of 80kW)

      IFmax [mA]: max filament current limit, default value in tube data file, value might be different (lower) after tube adaptation, e.g. Pmax tube > Pmax generator

      IFregelmax [mA]: = IFmax + analog offset value for regulation purposes during boost up, typically IFmax + 200mA

      Philips tube :

      FILsel :

      FILcir: physical filament circuit, see table *'filament converter PCB FU-mA EZ119'* above

      I0 [uA]: I0 = max emission current at Umin (typically 40kV = default)
      up to I110 = e.g. max emission current at Umax (typically 150kV = default)
      I120 [uA]: (I0 equals **40kV**) + (I110 equals **110kV**) = **150 kV**

all values in-between are (default) specified tube data coming from the installation disk data file, values (might) change when modified in the *'Tube Limits'* screen and after adaptation

CU physical fil: CU can handle 9 filaments at max 3 tubes, see table *'focus number CU EZ139 (0..8 = max 9)'* page 44

CU checksum fil:

- **Faultfind**
  - **Logging Tables**
    - **Read Actual Status** RE_AC_ST

      Gives the actual status of the filament circuit. Several entries are possible in the three fields.

      foc = see *'focus number FU-mA'* table page 44

      static = condition of the filament like:
      - FOCini no tube programmed
      - normal tube programmed and adapted

      dynamic = actual dynamic condition like:
      - off
        - no tube programmed
        - single focus tube, this circuit not in use
      - standby in standby without error
      - ctrl Xray during exposure or fluoro

    - **Read status Trace** RE_ST_TR

      Displays the last 10 activities with FU_mA. All fields have several entries possible.

      details to be continued

      time relative time [ms] of the last 10 status changes

      foc see *'focus number FU-mA'* table page 44

      old sta old static condition before status change

      old dyn. old dynamic condition before status change

      signal status change command

      new sta new static condition after status change

      new dyn. new dynamic condition after status change

    - **Read Error** ER_MA_1 ... ER_MA_6
      - **Error: Info**

        Displays an error code and sometimes the reason for the error entry.

        class: Three error classes are possible:

        - warning: Something happened being worth to be logged in the trace. Warnings are logged, but they are not displayed at the control desk and do not lead to a switch off of the exposure. If analog measurements e.g. increase the first limit, there will be an internal warning entry, which can be fixed during maintenance.

- error: An error always leads to an exposure off command. The error code will be displayed at the control desk, which can be reset with the **reset** labeled button or with any other.

- fatal: Fatal errors might be displayed at the control desk, but not in all cases. If there is a communication breakdown a fatal error might not be possible on the CAN bus.
As all error entries are logged in CU the information has to get to CU.
None of the units has a memory to keep the fatal condition when the generator has been turned off. So the information is lost. The only way to log it is by pushing the **on** button to warm reset the generator. Then the fatal error condition might be transmitted to CU.

error code: The error code is a 4 digit code.
The first 2 digits represent the function unit, see table in doc FAULTFINDING.
The last 2 digits give details of the error code, see details in doc FAULTFINDING.

error explanation: gives a brief explanation

task name: is the task name of the function unit process during the error **ignore** for troubleshooting

procedure name: is the procedure name of the FU process during the error **ignore** for troubleshooting

previous warning: might display a previous message

previous explanation: might display a previous explanation

parameter: might be displayed if available

- **Error: Actual Status**

Displays actual status during error: see *'Read Actual Status'* page 44.

- **Error: Status Trace**

Displays status trace during error, only 3 entries: see *'Read Status Trace'* page 44.

- **Error: HW Set Values**

If SW set (filament circuit 1) [mA]: filament current setpoint
filament circuit: see table page 44

If SW set (filament circuit 2) [mA]: filament current setpoint
filament circuit: see table page 44

Fl ON (filament circuit 1) : on = filament circuit 1 active (small focus)
- if all ready conditions present, activates triac V36 on EZ119 for intermediate DC circuit, but only in case of a two filament tube

off = filament circuit 1 inactive, e.g.
- during start up
- during adap of large focus
- error condition
- single focus tube (using large only)

Fl ON (filament circuit 2) : on = filament circuit 2 active (large focus)
- if all ready conditions present, activates triac

V36 on EZ119 for intermediate DC circuit
off = filament circuit 1 inactive, e.g.
- during start up
- during adap of small focus
- error condition

EN_STOP_X : on =
off =

EN_X_ACT : on =
off =

GRID control : on =
off =

GRID mode : on =
off =

- **Error: Read HW Values**

IF nominal (filament circuit 1) [mA]: filament current setpoint small focus
(see table page 44)

IF nominal (filament circuit 2) [mA]: filament current setpoint large focus
(see table page 44)

IF actual (filament circuit 1) [mA]: filament current actual value small focus
measuring point EZ119 X5 - (X8 gnd) 2.5A / V

IF actual (filament circuit 2) [mA]: filament current actual value large focus
measuring point EZ119 X7 - (X8 gnd) 2.5A / V

intermed circuit voltage (fil. cir. 1) [V]: intermediate DC supply of filament converter 1
small focus (typically 325VDC)

intermed circuit voltage (fil. cir. 2) [V]: intermediate DC supply of filament converter 2
large focus (typically 325VDC)

FU-mA version : hardware version of FU_mA

CAN identifier : address of unit on the CAN bus
ignore for troubleshooting

CTRL_X_C : on / off = status of CTRL_X_C/ signal during event

X_ACT_S : on / off = status of X_ACT_S/ signal during event

- **Error: Specific Informations**

might display information if relevant for event

- **Functional Tests**

- **test watchdog**

activates watchdog of FU_mA, red LED turns on and remains on, activate warm reset to restart generator
no PC access & communication during this (FATAL ERROR) status

- **Monitoring**

- **read If nominal** FI_C1_NO

type in filament circuit number, see table *'filament converter on FU-mA EZ119'* page 44

- **read If actual** FI_C1_AC

  type in filament circuit number, see table *'filament converter on FU-mA EZ119'* page 44

- **read intermed circuit voltage** RE_IN_CI

  type in filament circuit number, see table *'filament converter on FU-mA EZ119'* page 44

- **read Ie measuring trace** READ_IE

  A 'table' of 100 individual screen comes up, screen 1/100 is the last logged value, 100/100 the oldest.
  The mA value is measured every 2 ms. With low mA values (e.g. during fluoro or low-mAs tomo) there might be 0mA entries.

- **read 8 bit port**

  ignore for troubleshooting

- **read 16 bit port**

  ignore for troubleshooting

- **read memory**

  ignore for troubleshooting

- **Read Ie corrections** RE_IE_CO

  foc filament number, see table *'focus number FU-mA'* page 44

  Ie offset valid usual display: Ie offset O.K.

  correction active default display: Ie offset corr. active
  if tube adapted: Ie offset + R corr. active

  ofs [uA] default mA offset current value of mA measuring circuit G100 = 4000uA
  corrected value appears after adaptation

  R [Mohm] default value (no tube or nor adapted) = 0 MOhm
  corrected (measured during adaptation) value should be close to 200 MOhms
  this value is required to be filled in the mAs correction formula, see doc ACCEPTANCE

- **Adaptation Results**

  - **Select Adaptation Table for Reading** SE_AD_RE

    Only possible with an adapted filament.

    focus: type in filament number, see table *'focus number FU-mA'* page 44

    U [kV]: type in a kV value between 40...150kV (or whatever the limit is)

  - **Read Previously Selected Adaptation Table** RE_MA_TA

    Displays tables of different sizes (kV stage dependent) after the filament has successfully been adapted.
    Screen (or value line) 1/xx always displays the individual standby filament current at 100uA.
    Screen xx/xx displays a filament current which is just one step above the limit filament current.

If [mA] : filament current
lowest value = standby filament current
highest value = upper filament current limit + a little bit on top

table size depends on the filament current mA steps (individual for every kV stage)

Ie [uA] : emission current at the given filament current

boost time [ms] : how long it takes to boost up from a specific emission current (filament temperature) to a higher emission current (higher temperature) with the boost current = max filament current + 2A (positive boost)

blank time [ms] : how long it takes for the filament to 'cool down' from a specific emission current to a lower emission current (negative boost)

to get to a lower mA value the filament current goes down to 0.5A (0.5A is required as lowest current to feed a grid switch unit, if present)

typically the negative boost time is 2-3 times positive boost time

- **Select Unit** >hardkey<
  - **FU - kV**
    - **Adjust**
      - **IGBT Pulse Width Correction** DUTYCYCL

        see doc ADJUSTMENTS

        has to be carried out

        - after high tension tank replacement
        - after converter replacement (1 or 2)
        - after replacement of PCB kV_control EZ130
        - after exchange of PCB CU if no CU Complete (for the NVRAM) backup is available (value is stored in CU memory)
        - if the NVRAM has been erased or the battery is down and no backup file available
        - after changing the mains voltage value (see *'Mains data'*)
    - **Faultfind**
      - **Power On Results**
        - **Read Configuration** READCONF

          mains identifier : 1 = 3 phases
          0 = 1 phase (if signal SI_PH/ low active EZ130 X1:C14)

          power identifier : 0 = 50kW
          1 = 100kW
          2 = 65kW
          3 = 80kW

          control PCB identifier :

          maximum tubes : 1...3
      - **Logging Tables**
        - **Read Trace** max 10 entries possible RE_KV_TR

          time [ms] time [ms] after turn-on

          source-id multiple entries, to be continued

          information multiple entries, to be continued
        - **Read Error**
          - **Error: Info**

            class :

            error code :

            error explanation :

            task name :

            procedure name :

            previous warning :

previous explanation :
parameter :

error time [ms] :

- **Error: Trace**

  time [ms] time [ms] after turn-on

  source-id multiple entries, to be continued

  information multiple entries, to be continued

- **Error: HW Set Values**

  kV nominal (DAC) [kV] : setpoint of kV (control desk parameters)

  Z nominal value (DAC) [%] : duty cycle, load dependent

  converter control : reset
  normal work
  standby test
  prep test

  grid mode : no / yes (grid switch mode not yet available)

  high tension command : disable / enable

  power relay : on / off = ENK1 energized

  tube : 1 of 1...3

- **Error: Read HW Values**

  kV anode [kV] : actual value kV anode

  kV cathode [kV] : actual value kV cathode

  E value [V] : converter DC supply
  range (without warning) 400...780VDC

  converter 1 temperature ['C] : range without warning 0ºC...85ºC

  converter 2 temperature ['C] : range without warning 0ºC...85ºC
  only with 65/80kW
  with 50kW versions -273ºC (line open)

  ht-tank temperature ['C] : range without warning 0ºC...80ºC

  selected tube : 1 of 1...3

  grid mode : no / yes (grid switch mode not yet available)

  EN_X_C : on / off

  XACT_S | CTRL_X_C : on / off | on / off

  tube arcing : yes / no

  over voltage : yes / no

mains identifier : 3 phases
1 phase

power identifier : 10 = 1 converter (50kW)
00 = 2 converter (65/80kW)

power2 identifier : 00 = standard converter

control PCB identifier :

IGBT type identifier : Siemens
Toshiba (default, version will be identified during error)

- **Error: Specific Information**

might come up like (other entries possible):

act: kV anode during divider test [kV] : actual value of what appears in the text
min: kV anode during divider test [kV] : min deviation value of setpoint value
max: kV anode during divider test [kV] : max deviation value of setpoint value

- **Functional Tests**
  - **Test Watchdog**

activates watchdog of FU_kV, red LED turns on and remains on, activate warm reset to restart generator
no PC access & communication during this (FATAL ERROR) status

  - **Test DAC – ADC** KVDACADC

Start function: execution <OK> starts the digital - analog - digital test of the kV setpoint and the duty cycle channel

kV deviation [%] : result of measurement

allowed [%] : max deviation value, default 3 %

Z deviation [%] : result of measurement

allowed [%] : max deviation value, default 3 %

  - **Test Converter** TESTCONV

see doc FAULTFINDING

if DC value (E-value) too high, test will be cancelled

  - **Switch Error Handling**

break on error : yes / no to be continued

- **Monitoring**
  - **Measure Temperatures** MEASTEMP

tube temp switch : **short circuit** (against ground) = red traffic light on at control desk
closed = normal condition, green traffic light on at control desk
open = open cable connection / tube too hot, red traffic light at control desk

tube sensor ['C] : not yet available, **ignore**

converter 1 ['C] : range without warning 0ºC...85ºC

converter 2 ['C] : range without warning 0ºC...85ºC
only with 65/80kW
with 50kW versions -273ºC (line open)

ht-tank ['C] : range without warning 0ºC...80ºC

- **kV Measurements** KV_MEAS

  to be continued

- **Converter Measurements** CONVMEAS

  requested kV [kV] : value as set at the control desk

  kV nominal (ADC) [kV] : kV nominal, measurement only during exposure possible

  kV actual [kV] : total kV actual value, measurement only during exposure possible

  kV anode [kV] : kV anode actual value, measurement only during exp. possible

  kV cathode [kV] : kV cathode actual value, measurement only during exp. possible

- **Read 8 Bit Port**

  ignore for troubleshooting

- **Read 16 bit Port**

  ignore for troubleshooting

- **Read Memory**

  ignore for troubleshooting